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UNIVERSITY OF ALBERTA

ECONOMIC APPROACHES TO THE VALUATION OF SMALL WILDLIFE RESOURCES IN COMMUNAL AREAS IN ZIMBABWE

BY

LAURA L. GRAHAM

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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OF

MASTER OF SCIENCE

IN

AGRICULTURAL ECONOMICS

DEPARTMENT OF RURAL ECONOMY

EDMONTON, ALBERTA

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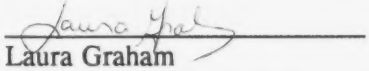

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Date: February 9/95

To my parents who have provided me with so much support and love.

ABSTRACT

The importance of small wildlife to communal area households in Zimbabwe is hypothesized to be significant yet little is known about the household's actual use and value of this resource. Through valuation small wildlife values can be incorporated into resource management. This study examined the use of small wildlife by communal area households and suitable valuation techniques that can be applied to these resources.

Field studies conducted in Chinamura and Nyanga districts collected descriptive and quantitative data. Nearly every household utilized small wildlife to some degree. However, the amount and variety utilized was influenced by household factors including wealth, remoteness, tastes, labour availability, religious beliefs as well as seasonality and wildlife availability.

Characteristics in communal areas may restrict the applicability of certain valuation methods. In particular, the application of travel cost and hedonic price non-market valuation are limited. However, contingent valuation lends itself to the communal area setting.

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TABLE OF CONTENTS

1.0 Introduction **1**
1.1 Introduction to study problem 1
1.2 Purpose and Objectives 3
1.3 Organization of the Thesis 5
1.4 Significance of Study..... 7

2.0 Background **9**
2.1 Profile of Zimbabwe 9
2.1.1 Physical Description 9
2.1.2 Economy 12
2.1.3 Political Institutions 12
2.1.4 Land Use, Distribution and Resource Control in Communal and Resettlement Areas .. 14
2.1.5 Historical Background to Natural Resource Problems 19
2.2 The Value of Trees and Non-Timber Resources .. 21
2.3 The Value of Wildlife 25

3.0 Theoretical Background **35**
3.1 Introduction 35
3.1.1 Natural Resource Economics 35
3.1.2 Welfare Economics 37
3.1.3 Economic Value 41
3.1.4 Household Production Function 44
3.2 Non-Market Valuation Methods 49
3.2.1 Introduction 49
3.2.2 Travel Cost Modeling 50
3.2.3 Hedonic Price Modeling 52
3.3 Contingent Valuation 54
3.3.1 Introduction 54
3.3.2 Theoretical Basis 56
3.3.3 Applications in Developing Countries .. 62
3.3.4 Hypothetical Variable Influencing CV Values..... 72
3.4 Summary..... 73

4.0 Methodology **74**
4.1 Introduction 74
4.2 Study Area 75
4.2.1 Chinamura Study Area 77
4.2.2 Nyanga Study Area 79
4.3 Sampling 81
4.4 Interview Design 84

5.0 Results of Field Research **90**
5.1 Introduction 90
5.2 Chinamura Study Area 91
5.2.1 Area Description 91
5.2.2 Small Wildlife Utilization 93
5.2.3 Collection of Small Wildlife 101
5.2.4 Use of Small Wildlife 104
5.2.5 Marketing of Small Wildlife 104
5.2.6 Reasons Not To Consume Small Wildlife . 109
5.2.7 Attitudes Towards Small Wildlife 112
5.2.8 Willingness To Pay 114
5.2.9 Discussion of Results 114
5.3 Nyanga Study Area 119
5.3.1 Area Description 119
5.3.2 Small Wildlife Utilization 120
5.3.3 Political Arrangements 124
5.3.4 Discussion of Nyanga Results 125
5.4 Opportunistic Interviews 126
5.5 Conclusions 128

6.0 Framework **131**
6.1 Conceptual Framework 131
6.1.1 Household Production Model for Communal Areas Households in Zimbabwe 131
6.1.2 Derived Demand Approach 139
6.1.3 Other Valuation Approaches 143
6.2 Analysis of Non-Market Valuation Methods in Zimbabwean Context 148
6.2.1 Travel Cost Modeling 148
6.2.2 Hedonic Price Modeling 150
6.3 Contingent Valuation 151
6.3.1 Factors Affecting Application in Zimbabwe 151
6.3.2 Hypothetical Variable To Consider With CV 160
6.3.3 Methodological Issues 166
6.3.4 Summary 179

7.0 Discussion and Implications **180**
7.1 Summary 180
7.2 Conclusions and Implications 185
7.3 Recommendations For Further Research 188

Bibliography 192

Appendix A 216
Supplement To Profile of Zimbabwe

Appendix B..... 230
Map B.1 Major Velds of Zimbabwe
Map B.2 Agro-Ecological Regions
Map B.3 Distribution of Major Agricultural Land Use Categories
Map B.4 Natural Regions and Communal Lands

Appendix C 235
Table C.1 Botanical Index
Table C.2 Inventory of Wildlife Utilized in Zimbabwe
Table C.3 Nutritional Content of Wildlife
Table C.4 The Use of Indigeneous Trees For Insects

Appendix D 249
Table D.1 Chinamura Field Results
Table D.2 Store Prices
Table D.3 Nyanga Field Results
Table D.4 Timeline

Appendix E 275
Literature Search

LIST OF TABLES

TABLE 2.1	Market Prices of Meat in West African Countries	28
TABLE 5.1	Number of Households Utilizing Small Wildlife	94
TABLE 5.2	Wealth Groupings of Study Households in Chinamura	98
TABLE 5.3	Number of Households Utilizing Wildlife According To Wealth Groupings	98
TABLE 5.4	Classification of Households According To Remoteness	99
TABLE 5.5	Number of Households In Each Remoteness Category Based On Wealth Groupings	99
TABLE 5.6	Number of Households In Each Remoteness Category Utilizing Wildlife	100
TABLE 5.7	Number of Households Involved In Marketing Wildlife Products	105
TABLE 5.8	Marketing of Wildlife Products By Households According To Wealth Groupings	105
TABLE 5.9	Marketing of Wildlife Products By Hshlds According To Remoteness Classification	108
TABLE 5.10	Reasons Cited For Not Consuming Wildlife	108
TABLE 5.11	Number of Hshlds In Each Wealth Grouping Citing Particular Reasons For Not Consuming Certain Wildlife	113
TABLE 5.12	Number of Hshlds In Each Remoteness Category Citing Particular Reasons For Not Consuming Certain Wildlife	113
TABLE 5.13	Number of Hshlds Who Desire Wildlife According To Wealth Grouping	113
TABLE 5.14	Number of Hshlds Utilizing Small Wildlife	121

TABLE A.1	Land Distribution by Agro-Ecological Regions	222
TABLE A.2	Land Use Categories	227
TABLE A.3	Percentage Distribution of Land Use by Agro-Ecological Regions	228
TABLE C.1	Botanical Index	236
TABLE C.2	Inventory of Wildlife Utilized In Zimbabwe	238
TABLE C.3	Nutritional Content of Wildlife	247
TABLE C.4	Use of Indigeneous Trees For Insects	248
TABLE D.1	Chinamura Field Results	250
TABLE D.2	Store Prices	264
TABLE D.3	Nyanga Field Results	265
TABLE D.4	Timeline	274

LIST OF MAPS

MAP 4.1	Study Areas	76
MAP B.1	Major Velds of Zimbabwe	231
MAP B.2	Agro-Ecological Regions	232
MAP B.3	Distribution of Major Agricultural Land Use Categories	233
MAP B.4	Natural Regions and Communal Lands	234

1.0 INTRODUCTION

1.1 INTRODUCTION TO STUDY PROBLEM

Zimbabwe is a country richly endowed with natural resources. However along with this endowment there also exists some serious resource allocation issues. Distortions in natural resource use arise from historical as well as current causes. In the 19th century, colonization disrupted the traditional system of resource use and management. Land was appropriated for settlers and many people were removed from their traditional land and relocated onto marginal lands. As a result, the majority of Zimbabwe's present population resides in communal areas on land that is generally of low quality. Population pressure on the available resources, including trees, non-timber resources and grazing areas, is often high. This population-resource imbalance is resulting in over-utilization, degradation and depletion. However, not only are the problems environmental but they also have strong social implications.

After independence in 1980, land redistribution was the priority. However, it has been a slow and politically delicate process that is yet to be resolved. In conflict is the social welfare of a large portion of the population and the fact that the land that is being redistributed is presently owned by commercial farmers. The commercial farmers own vast tracts of highly productive land. They contribute to the country's GNP and provide valuable export earnings therefore they are important to the country's economy. Also, the resettlement schemes that were carried out to address the redistribution of land have not always been successful. As a result, some of these are also facing environmental degradation and low productivity.

Current causes of resource problems also include policy and institutional failures. These failures illustrate the inappropriateness of maintaining past colonial systems which do not reflect the current population's needs. Inefficient government institutions and ineffective environmental legislation as well as a lack of research has prevented progress in addressing natural resource problems.

Deforestation is one serious resource issue currently existing in several communal areas. Tree resources are being threatened by population pressure. While tree scarcity may not necessarily be a problem in the short term in all communal areas, it could potentially be a very serious problem in the long term. This problem is a cause for concern because trees are essential to people in communal areas for many uses. Scarcity of this resource could have serious ramifications on these populations.

As a result, more research has focused on the issue of deforestation, particularly the valuation of tree resources. Recognition of the value of non-timber resources has also created the need for research in this area to fill in large information gaps. The contribution of the non-timber values to overall forest values could cause a significant increase in the recognized value of the trees and subsequently should alter management of these resources.

Small wildlife and insect use by people in communal areas represents one relatively unexplored area in non-timber use. Trees provide habitat for this wildlife which is hypothesized to provide benefits to the farmers through use as food. However the importance of the wildlife use is basically unknown. Through exploring wildlife use this study should serve to fill this information gap.

The area of non-market valuation is a vast and growing field. However, much of this research has been done in

developed countries and may not be directly transferable to developing countries. Another aspect of this study is to consider these valuation methods in a developing country context and provide insights into appropriate valuation methods to apply to these resources.

1.2 PURPOSE & OBJECTIVES OF THE STUDY

This research is intended to focus on the economic valuation of small wildlife resources. For the intent of this research, small wildlife resources will refer to those faunal species that are utilized by households in communal and resettlement areas[1]. These wildlife species include small mammals and birds as well as insects but exclude large game. The study does not consider species, such as large game, that are utilized for tourism or commercial use, because a market value can be determined for these species and also they do not represent direct use to people in the communal or resettlement areas.

This study is conceptual and is intended to consider the economic and social issues involved in wildlife use. Literature research will involve compiling all available information on small wildlife and insect use and collection, nutritional content and marketing found in various studies. Socioeconomic data will also be extracted from various household surveys. Through field research, general data will be collected about uses and quantities of wildlife resources. The purpose of this study is not to do a detailed data collection but rather to get a general overview and contribute to documentation of wildlife

[1]The term wildlife is much more encompassing and includes all flora and fauna, however the definition has been restricted for this study. Therefore references to wildlife are referring only to the small wildlife as defined.

resources. Different questions and valuation methods will be attempted to determine which are suitable. As well, a description of the socio-economic environment, relating to wildlife use and natural resources in general, will be provided for further studies. The end result will have two purposes: First, to provide the necessary background information for any future valuation studies conducted by others. Second, to propose a model or framework of valuation methods that could be used for subsequent economic valuations. In this way the study should complement previous work and supplement further work.

Objectives of the study include:

1. To observe the household's use of small wildlife resources and to infer the magnitude and relative importance of wildlife in meeting their needs. Information gathered will include which resources are used, their uses and general amounts.

2. To examine household and communal area socio-economic characteristics that influence small wildlife utilization. These characteristics will be identified through literature review and field observations.

3. To provide a qualitative description of the study environment based on objectives one and two.

4. To determine what type of household socio-economic and small wildlife use data can be collected. Review of other household studies from different fields will be used to identify potential data collection problems and suitable approaches.

5. To determine what type of valuation questions are appropriate and what methodological issues may be encountered.

6. To assess different empirical methods of wildlife valuation based on objectives four and five to determine which methods may be successful. A framework for further empirical valuation work will be developed. This framework will suggest appropriate valuation methods, and discuss data collection and methodology issues.

1.3 ORGANIZATION OF THE THESIS

The organization of this thesis is unconventional due to the nature of the study which involved considerable analysis of literature as well as the field study to develop the final framework. As a result, considerable literature review is found throughout the chapters.

Chapter two initiates the study by providing background to the Zimbabwean situation. This background includes a Profile of Zimbabwe which outlines the physical, economic, political and resource aspects of Zimbabwe as well as some historical background to resource problems. This broad perspective then narrows to look at tree and non-timber resources and finally, more specifically at wildlife resources which are the focus of the study.

Chapter three then develops the theoretical background for the valuation aspects of the study. Natural resource economics, welfare economics, economic value and the household production function are introduced. Following are non-market valuation methods including travel cost modelling and hedonic price modelling with contingent valuation being discussed in greater depth in terms of its application in developing countries.

Methodology is described in Chapter four. Initially the conduct of the field research is explained and rationalized.

Next, the two field study areas are described. Then sampling methodologies and terms are defined. Finally, interview design is discussed.

The results of the field research are then presented in Chapter five. This chapter includes the results for two research areas. The first study area is the main field study while the second smaller study serves to provide supplementary information and comparison. Additional opportunistic interviews also supplement the field studies. The results and discussion for each study area are presented separately before being discussed together.

Finally, a framework is developed in Chapter six. A conceptual framework for the communal area households is established through the household production function. Possible valuation approaches are discussed. In particular, the non-market valuation methods are analyzed in terms of Zimbabwe with emphasis on contingent valuation. Methodological issues regarding valuation and data collection are explored and hypothetical variable for contingent valuation are suggested.

Several supplementary appendices are included at the back. Appendix A includes a supplement to the profile of Zimbabwe which expands on the information presented in the profile in Chapter two as well as providing tables. Various maps of Zimbabwe to supplement the Profile of Zimbabwe are found in Appendix B. These maps represent the major velds of Zimbabwe, agroecological regions, and distribution of land use. Appendix C contains various tables. These include a botanical index for trees species mentioned in this study. There is also a table compiling an inventory of the small wildlife species that have found to be utilized by communal area households in Zimbabwe. This table was developed from the field study as well as literature sources and these sources are referenced with respect to each species.

Common, scientific and indigeneous names are included in this table. The nutritional content of some small wildlife is found in another table. Also, there is a table of some trees which are used for edible insects. Appendix D contains the field results data for Chinamura and Nyanga as well as a table of the store prices of selected basic goods in Chinamura. A timeline developed from the field studies represents the wildlife seasons with respect to agricultural activities and seasons. Finally, Appendix E discusses the various sources contacted in gathering literature and data.

1.4 SIGNIFICANCE OF THE STUDY

This research was conducted under the auspices of the "Value of Trees" project. This five year project is funded by IDRC. It is a joint project between the University of Alberta, Edmonton, Alberta, Canada and the University of Zimbabwe, Harare, Zimbabwe. Involved are the Department of Rural Economy at the University of Alberta and the Department of Biological Science, Department of Agricultural Economics and Extension, and the Centre for Applied Social Sciences at the University of Zimbabwe. The objective of the "Value of Trees" project is to develop, test and assess the applicability of methodologies to quantify the benefits and costs of tree components in small farm production systems in southern and eastern Africa. Research will be conducted by 13 graduate students from the Universities of Alberta and Zimbabwe. These students will carry out their course work at the University of Alberta with the field work being conducted in Zimbabwe.

Involvement in the "Value of Trees" project arose out of an interest in the opportunity to conduct research in Zimbabwe. The project jointly allowed me to conduct research pertaining to my Master's Degree in Natural Resource

Economics while supplying me with experience working and living in a developing country, thus enriching my academic experience. The project also allowed me to use my background in the areas of Natural Resource, Environmental and Development Economics. The idea for the research was based on previous interest in wildlife resource valuation in Canada. Subsequent discussions with professors from the University of Alberta and the University of Zimbabwe also supported the pursuance of this topic.

This research study contributes to the general purpose of the "Value of Trees" project by helping to fill an information gap through determining methods for assessing values for wildlife resources. These wildlife values contribute to the overall value of trees. This research should have the potential benefit of providing the background and preliminary work into wildlife use and valuation which should instigate further research into wildlife valuation. As well, the suggested methodologies may also be applicable to other non-timber resources. The subsequent non-timber values could then be applied to the the deforestation issue to better enable management of these resources.

2.0 BACKGROUND

2.1 PROFILE OF ZIMBABWE

2.1.1 Physical Description

Located in South-central Africa, lies the resource and population rich country Zimbabwe[1]. Zimbabwe covers an area of 390 757 km^2 and supports a population of 10 401 767 which is growing by 3.1% annually (Central Statistics Office, 1992). Located in South-central Africa, this land-locked country is bounded by Botswana to the west, Zambia and the Zambezi river to the north, Mozambique to the east, and South Africa and the Limpopo river to the south.

The country is divided into three main altitudinal regions (Map B.1, Appendix B). The highveld, a high plateau above 1200 m, dissects the median of Zimbabwe. This area includes the most fertile land. The less fertile middleveld lies to each side of the highveld at 900 - 1200 m. The lowveld encompasses the remaining land which falls below 600m. However, because of the hot, dry conditions, the lowveld is unsuitable for agriculture. Significant regions within the velds include the Eastern Highlands, Kalahari sandveld, Zambezi valley and the Save valley.

Zimbabwe is classified into five agroecological regions (Map B.2, Appendix B). The agricultural potential of the land declines from natural region I to V. Natural region I has high rainfall and low temperatures. Specialized diversified farming, such as dairying, forestry, tea, coffee, fruits, maize, etc. is possible here. Natural region II is an intensive farming region with moderate rainfall. This

[1]Further details profiling Zimbabwe are included in Appendix A.

region is suitable for rainfed crops including maize, tobacco, cotton as well as beef production. While rainfall is moderate in Natural region III, there can be severe dry spells. As a result, this region is marginal for maize, tobacco, cotton or sole crop production. However, livestock production is suitable. Natural region IV experiences low rainfall and successive seasonal droughts. Drought-resistant fodder crops are possible here but the region is marginal for rainfed maize and unreliable for cash crops. Rainfall in Natural region V is very low and erratic. This land can only support extensive cattle and game ranching or irrigation cropping. The distribution of population with respect to these natural regions is a key issue in resource problems. Much of the population is distributed in natural regions III - V, resulting in environmental problems.

The climate of Zimbabwe, although located within the tropics, is sub-tropical due to its inland position. Three distinct seasons include the hot, dry season from August to November. The buildup in heat and humidity leads to the hot, rainy season from November to April and is followed by the cool dry winter season from May to August. Temperatures and rainfall vary across the velds with higher temperatures and lower rainfall in the Middleveld and Lowveld. Temperatures in Harare, located in the highveld, range from $29^{o}C$-$16^{o}C$ in the summer and $21^{o}C$-$6^{o}C$ in the winter. Rainfall is highest in the Eastern highlands and on the highveld. These areas receive an average of about 1 000 mm annually. However, annual rainfall in the lowveld may be below 400 mm and even as low as 50 mm a year. Periodic droughts are also experienced particularly in the Lowveld and parts of the Midveld.

Vegetation in Zimbabwe is varied[2]. Miombo woodland and scrubland is found in the highveld and middleveld while mopane woodland and scrubland is found in the lowveld. Afromontane forest and grassland cover the Eastern Highlands. However, in the Southwest there is acacia scrubland. Dry forest scrubland typifies the Kalahari sandveld.

Zimbabwe's soils are derived predominantly from granite. The eight main soil groups include: regosols, lithosols, vertisols, siallitic, fersiallitic, paraferrallitic, orthoferrallitic and sodic. These soils are often light and sandy and therefore of only fair agricultural potential.

With no natural lakes, Zimbabwe relies on over 8 000 dams to collect rainfall to support the high demands of agriculture and the people. Wells and boreholes are also used by many households. These are often shared resources in the communal areas. Zimbabwe's water resources are however threatened by increasing siltation and pollution.

Over 40 varieties of minerals are found in this country. These are dominated by gold, asbestos, nickel, iron, coal, copper and chrome as well as limestone, silver, tin and others. Large scale reserves of coal, hydropower as well as woody biomass fuel the country's energy needs. With almost six million people dependent on fuelwood, nearly four million tonnes of wood is consumed annually (HIFAB, 1989).

Wildlife resources are rich and varied[3]. These include over 270 mammalian species, 640 avian species, 153 reptilian species and countless insect species. While many of these are protected within national parks, they provide conflicts

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[2]Table C.1, Appendix C lists the scientific and indigeneous names for tree species that are relevant to this study.

[3]Table C.2, Appendix C lists the scientific and indigeneous names of wildlife species that are relevant to this study.

with human needs in communal area. Increasing population and agricultural clearing has removed suitable habitat and driven many of these species away.

2.1.2 Economy

Zimbabwe's economy is dominated by the agricultural sector. Agricultural output is mostly supplied by the large scale sector. However, communal area production does contribute about one-third of total agricultural production without even accounting for the 61% of production that is withheld for household consumption. While the forestry sector is relatively small, Zimbabwe is self-sufficient in wood. The manufacturing sector is the largest productive sector and produces over 6000 different products. Mining and quarrying as well as several other industries also contribute to GNP.

2.1.3 Political Institutions

The following political institutions in Zimbabwe are those which are relevant to managing natural resources in communal areas. These institutions include local and national government. The Department of Rural Development is responsible for rural development at the local and provincial levels. The development process is administered and funded by the Ministry of Local Government and Urban Development and conducted through the Provincial Development Committee (PDC), the District Development Committee (DDC), the Ward Development Committee (WADCO) and the Village Development Committee (VIDCO).

The District Administrator presides over the DDC at the district level. District development plans are developed which are funded through a limited District Development Fund. District natural resource subcommittees advise on these district development plans. However, these

recommendations are often not taken seriously because they do not generate funds for the DDC.

At the local level the VIDCO, headed by the village headman, identifies and articulates village needs to develop village development plans. The WADCO is headed by the local councillor and is also involved in development plans. However VIDCOs and WADCOs differ in that VIDCOs control villages which are demarcated under traditional boundaries. WADCOs however involve wards which are politically demarcated and may involve several villages and different parts of a village may even fall into different wards. Due to a mixture of traditional and institutional control, the nature of the political control and jurisdictions in communal areas is often unclear.

Nationally, the Department of Natural Resources (DNR) operates under a statutory mandate derived from the Natural Resources Act. The DNR implements the Natural Resources Board which supervises natural resources. The Department of National Parks and Wildlife Management (DNPWM) manages parks and wildlife lands, as well as indigenous plants and animals within communal areas and resettlement areas. The Parks and Wildlife Act controls exploitation of plants, trees and wildlife. The Communal Land Forest Produce Act further derogates this protection in the communal areas.

The Forestry Commission is involved with timber, and to some extent, non-timber use of state forest. However, through their Social Forestry initiatives they may begin to play a more direct role in use of these resources. These initiatives would allow sharing of the forest resources with adjacent communal areas. This, however, involves several difficult issues which are presently not resolved. The Forestry Commission is also involved in the wildlife industry, particularly management of large game and safaris.

2.1.4 Land Use, Distribution and Resource Control in Communal and Resettlement Areas

There are five major land uses in Zimbabwe. The land use categories include: Communal areas; Resettlement areas; Commercial Farms; Parks and State Forests; and Urban areas. Of interest in this study are the communal and resettlement areas[4]. An understanding of these land uses and their population distribution, with respect to the agroecological regions, is important to an understanding of natural resource problems (Maps B.3 & B.4, Appendix B).

The Communal areas accommodate 57% of Zimbabwe's population. Derived from pre-independence Tribal Trust Lands, these areas cover 42% of the land. The extent of socio-economic differentiation varies between agroecological regions (Wilson, 1990). However, due to historical reasons, 73.5% of this area is located within Natural Regions IV to V which is generally not suitable for present uses due to poor soil and low rainfall. Even within regions, communal farmers are often located on poorer, nutrient poor soils (Whitlow, 1982). As a result, productivity is low and environmental degradation results.

Communal areas are characterized by small-scale, low-input, agro-pastoral systems[5] (Sayce, 1987). There is also a heavy reliance on environmental resources. However, shifting cultivation is not practiced as in other subsistence cultures (Campbell *et al*, 1991). Individual homesteads consist of small arable fields surrounding the homestead and some households have garden plots. Various crops, vegetables and fruits are grown on these farms. These products are mainly used for household consumption. However, some is marketed which provides necessary income.

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[4]Further descriptions of the other land uses and distribution are included in Appendix A.

[5]A more detailed description of households in communal areas is included under Section 6.1.1.

Livestock is usually kept including cattle, donkeys, goats and chickens. Livestock mainly supplies inputs such as draught power and manure, although it can also serve as a source of income or food. There is also a heavy reliance on environmental resources for products. Incomes are generally lower in these rural areas compared to the urban areas.

Customary law co-exists with the general laws creating a legal dualism in communal areas (Stewart *et al*, 1990). Villages or kraals therefore have traditional as well as institutional structures. The traditional structure involves large chieftaincies. These are subdivided into districts or wards which include several small villages. These villages are under leadership of a headman or kraal head. However, after independence local government structures were set up and the villages were demographically redefined to include about 1 000 people. These politically defined villages fall under VIDCO leadership.

A lack of entitlement to resources is central to natural resource management problems in communal areas in Zimbabwe (Chimedza, 1989). While there are no formal property rights, land is allocated by the village headman under an informal type of ownership. The trees and resources within these homesteads are considered the property of the resident (Wilson, 1989a). Resources in the communal grazing areas, such as grazing, water and timber are considered communal property and subject to open access. People have fundamental rights to the communal resources which are governed under certain customary laws. Wildlife is generally considered communal property. However wildlife that is within a homestead, such as a tree with caterpillars or a mound of termites, is attributed to that household. Other wildlife, such as mice birds, hares, buck and wild pigs, however can not be demarcated as there is no way of controlling its movement.

Legal barriers prevent unrestricted use of large and some small game. In order to apply for a licence, the applicant needs an approved weapon, must be literate enough to complete the forms and must have access to the application centre. This effectively excludes many communal households and in particular women.

Community management of many wild resources has long existed. Through a combination of the people's knowledge of key resources as well as high values placed on many resources, individual and community level resource management strategies have been adopted. However, time constraints may lead to bad management practices such as setting grasslands on fire to trap rats and hares (Chimedza, 1989). Branches or entire trees may be cut down in order to secure ownership of caterpillars (Wilson, 1990). Agricultural practices may also conflict with wildlife management. Termite mounds may be destroyed to supply fertile soil, land clearing eliminates habitat for certain wildlife and pesticides render the pests unfit to eat (Chimedza, 1989).

The controls and restrictions regarding natural resource use may be traditional controls or institutional rules. These controls include religious and pragmatic controls, the civil contract and institutional controls (Nhira & Fortmann, 1991; 1993). Religious controls are exercised by traditional religions which exist in Zimbabwe. These traditional religions issue mandates regarding use their member's use of the environment[6]. Certain areas or specific species may be considered taboo or have certain rules for their use. Sacred areas exist where hunting is prohibited. Certain species are also taboo because they represent a person's totem.

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[6]Descriptions of religious controls in Zimbabwe can be found in Bourdillon (1979), Matose (1991), Mazambani (1991), McGregor (1989), Garbett (1969), Gumbo *et al* (1989), Wilson (1987).

The Apostolic faith, which is found throughout communal areas, has a strong environmental ethic. Their teachings actually prohibit consumption of certain species of small wildlife and insects in order to conserve these resources. These religious restrictions may be altered depending on the status of the wildlife. Wilson (1990) found that households belonging to 'independent' churches did not eat caterpillars due to Biblical prohibitions. Therefore in this area where these households predominate, overall consumption was low.

Traditional religions originally were communal institutions which involved the entire population in an area. However, this situation is rapidly disappearing resulting in a breakdown of these religious controls (Nhira & Fortmann, 1991). Immigrants often do not observe these controls thus reducing the success of community management.

However, religious organizations have also formed to conserve resources (ZIRRCON, 1991). These groups are based on traditional and new religions. Examples are the Association of Zimbabwean Traditional Ecologists (AZTREC) and Association of African Earthkeeping Churches (AAEC) which are tying to combat deforestation.

Pragmatic controls have also been observed in various studies (Gumbo *et al*, 1989; McGregor, 1989; Scoones, 1988; Wilson, 1987). These are norms of use and protection to conserve a resource. Various reasons are given to justify these restrictions on resource use. Due to the nature of communal areas a certain amount of resource control is also through the civil contract. These norms of civility govern daily conduct and restrict avaricious behavior. However, evidence suggests that this is breaking down, especially with increasing resource scarcity (MacGregor, 1987; Nhira & Fortmann, 1991). Also, individuals are staking claim to certain resources that were originally communal (Matose, 1991, Nhira & Fortmann, 1991).

Institutional control over resources has been attempted by VIDCOs (Wilson, 1987; Nhira & Fortmann, 1991; Matose, 1991). They may prohibit use of a resource or require that people receive written permission. Also within the ward or village, committees or institutions may be set up to deal with problems (Nhira & Fortmann, 1991). Hunting controls may restrict hunting periods or ban the killing of young animals (Wilson, 1989b, 1990). Hobane (1994) found that community members had come up with a "by-law" which stipulated how caterpillars were collected. Collectors could not dig up caterpillars in the pupation stage, make fires in the forest to roast the caterpillars, or camp in the forest to collect. Outsiders were also barred from collecting in the area. However, the "by-law" was not actually legal.

The strength and degree of enforcement of these controls and restrictions may vary between villages (Campbell *et al*, 1991). While in some areas community management is strengthening (Wilson, 1987) in others areas it is breaking down (Campbell *et al*, 1991). Many of these rules developed when there was resource abundance, however the resource situation is changing. Hunting laws and taboos are now often quietly ignored (Wilson, 1990). Commercialization of some species may also be leading to a break down in traditional resources controls (Hobane, 1994). Also, some people feel that because these resources are from God that no one has a right to regulate their use. Conflicts over use and control are arising because of population pressures on limited resources. The result is environmental degradation and depletion. However, in response, new resource management strategies are also developing.

In order to deal with this distribution problem, resettlement schemes were derived. Currently, 3.3 million hectares or 6.8 % of land has been allocated to this use.

This reallocated land comes from appropriated commercial farms and is mainly located in agroecological regions II, III and IV. Through this program, landless peoples, squatters and returning refugees are allocated at least 5 ha of cropping land and 15 ha of grazing area.

While resettlement schemes have relieved some pressure on the communal areas, these schemes have not been entirely successful. Inputs are often required because the land is usually located in regions III and IV[7]. However, the people being resettled often lack capital. This has stimulated exploitation of the environment in order to create income and has led to the degradation of the land. As a result the investment in these schemes was not always justified (Government of the Republic of Zimbabwe, 1992). Therefore better planning and some type of conservation measures may be necessary for success of these schemes.

2.1.5 Historical Background to Natural Resource Problems

Present day conflicts and distortions in natural resource use are attributed to Zimbabwe's historical legacy of inequitable access to land and resources as well as current policy and institutional failures (Gore *et al*, 1992). Prior to the 19th century, there was no land scarcity or resource management problems (Gore *et al*, 1992). People used the resources in such a way as to avoid degradation. In the early 19th century, the first European settlers arrived and competition for land arose. The first "Chimurenga" occurred, which resulted in the colonials appropriating land and mining rights, while forcing the peasants onto marginal land. In 1980, the second "Chimurenga" brought independence. Land redistribution was the priority. However, under the Lancaster House Conference, the British

[7]This is due to a willing buyer-willing seller clause which was in effect until 1980. This clause stipulated that land that was purchased for resettlement schemes had to be willingly sold. As a result, most commercial farmland that was sold was of marginal quality.

would only provide redistribution funds if there was a ten year willing buyer-willing seller clause. This meant that commercial farmers could not be forced off their land but had to be willing to sell their land for redistribution. This clause expired in 1980 and was removed. However, the redistribution of land is a very complex issue and is yet to be resolved.

The apportionment of land and resulting duality in the agricultural sector has been an overriding feature of land use. Improper distribution of population with respect to resources has strongly affected environmental development and conservation. The distribution of commercial and communal farm land in relation to agricultural potential has exacerbated the environmental and social problems.

The communal areas, most of which are found on low potential land, contain the majority of the population. Population densities in these areas may exceed 50 persons/km^2 (Ashworth, 1990). This population-resource imbalance means that the land is over-utilized resulting in low productivity and income. These densely populated areas also tend to be relatively deforested (Whitlow, 1980; Whitsun Foundation, 1981; du Toit and Campbell, 1988). In contrast, the commercial farms and state land, which are occupied by a minority, are on the more fertile land. However, although these lands have high productivity and incomes they are often underutilized.

Resettlement programs were initiated in 1981 to redress the land distribution issue. However these have contributed little to relieve land pressure given the magnitude of the population-resource imbalance. Furthermore, resource problems are also evident in these areas such as rapid deforestation (Grundy *et al*, 1992).

As well as distribution inequality, colonial-based policies and institutions have also contributed to resource problems by failing to address the problems of the majority. Government institutions are often inefficient and overlap. A lack of hierarchy among different acts has generally rendered environmental legislation ineffective. Up-dated and stronger legislation with established standards is needed. However, the government often has economic and political motives which outweigh environmental considerations. Further environmental research is also needed. Particularly in the communal areas, scientific knowledge is needed to adequately portray the local valuation of natural resource systems (Gore *et al*, 1992).

A fundamental issue behind conflicts and distortions in the use of wildlife resources in Zimbabwe is that of polarized perceptions and approaches. Among residents of communal areas, wildlife constitutes a source of protein. Hunting or collecting wildlife is aimed at meeting this need. Government regulations however, emphasize aesthetic and commercial values of wildlife while preventing access by communal area dwellers (Gore *et al*, 1992).

2.2 THE VALUE OF TREES AND NON-TIMBER RESOURCES

Deforestation is one issue gaining increasing research interest. This problem currently exists in some communal areas and could become a problem in other communal areas. Indigenous woodlands formerly covered 23 million hectares or about 60 % of Zimbabwe's land (McNamara, 1993). However, with increasing population, this forested area is rapidly decreasing at a rate of 1.5% annually (Gore *et al*, 1992). Former woodlands are now much reduced in quantity and quality. The remaining 10 million hectares of woodlands, forests, and trees in communal areas is of variable quality

and in some areas only consists of scattered trees. The forest surrounding the communal areas can probably best be described as a social forest. Fortmann and Nhira (1993) define a social forest as a woodland area which has been partially and selectively cleared by a farming community.

The value of trees is through the many benefits they provide. Trees are an important source of energy by providing fuelwood for cooking, heating and lighting. They provide timber and materials for building, fencing and making utensils, crafts, furniture and ropes. They also represent savings and investments which may be required to meet social obligations. As well, trees supply many non-timber benefits by providing important habitat for various flora and fauna which play a significant role in local economies (Asibey, 1988; Murindagomo, 1988). Several foods can be obtained from the forests such as fruit, honey, wild vegetables and plants, insects and small wildlife. Trees also provide soil inputs, livestock fodder, medicine and several intangibles such as shade, climate control, even spiritual, aesthetic, and psychological value.

These non-timber resources, however, are hard to value because there are no organized markets for many of the benefits of their uses. However, Peters *et al* (1989), in their valuation of an Amazonian rainforest, clearly demonstrated the importance of non-timber forest products. As well as yielding higher net returns per hectare than timber, these non-timber resources can be harvested with much less damage to the forest. It may be possible that these "secondary" products may have a greater Net Present Value than the timber (Muir, 1991).

Of greater significance than the market value of these non-timber products may be the value of these products as subsistence products (Campbell & Brigham, 1993). Wild foods constitute an important part of the diet and contribute to

household food security for most rural households in Africa (Chimedza, 1989). Studies on woodland use by communal area households in Zimbabwe found that poorer households were often more heavily dependent on woodland for these non-timber resources (Wilson, 1990; Scoones, 1990; McGregor, 1991). Women and children, in particular, may supplement their income or subsistence needs by collecting forest products (Appasamy, 1993).

Forest resources provide a potential range of income sources. As a result, households can spread their risk and reduce their exposure to the impacts of drought. That capability to spread risk is greatest among household which can exploit resources in their microenvironments (Wilson, 1990).

These resources can also provide buffer stocks of food during food stress as well as income during difficult times. Importance may vary with seasonality such as late in the dry season and before harvest when inputs may be scarce. While individuals gather wild fruits, fish and hunt in good and bad years (Fleuret, 1979; Malaisse & Parent, 1985; Ogle & Grivetti, 1983), these activities become more important during times of food stress (Campbell, 1986; Gibson, 1977; Kinsey, 1986). Certain foods can be classified as famine foods. Famine foods are foods that may not normally be eaten or may have a particular use during normal times. However, their use may change during times of food stress. For instance in Zimbabwe, fruits normally eaten as snacks may be dried for later use instead (Zinyama *et al,* 1988).

All land use values including non-timber and non-market values, need to be considered when making land use decisions to prevent natural forests from being undervalued (Muir, 1991). However, non-timber products and their value constitutes a relatively unexplored area (Chopra, 1993;

Godoy, Lubowski & Markandya, 1993)[8]. While minimal research is available on the role of non-timber products, the studies do indicate the important role of these products in food security and income generation (Asibey, 1988; Chimedza, 1989). Literature on non-timber forest products recognizes the need to improve the valuation of social and economic benefits from these products (de Beer & McDermott, 1989; FAO, 1991; Scoones & Matose, 1992a). However, Peters *et al* (1989) feel that the problem is not in the actual valuation of the resources but in the failure of policy to recognize these values.

Research on the development of indigenous resources in Africa is essentially non-existent and the few existing studies on the utilization of flora and fauna are poorly documented (Muir, 1988a). Muir (1988a) suggests that it is time to "test the hypothesis that unconventional and indigenous flora and fauna can increase incomes and/or reduce environmental pressure in marginal lands". Therefore, there is an urgent need to carry out research on the role of wild flora and institutions for managing these resources (Muir, 1988a). So far, most of research has focused on Latin America. More studies are needed from Africa because values may differ due to different harvesting methods, forest types, securities and economies (Goday, Lubowski & Markandya, 1993).

It is recognized that the non-timber uses of the forests in Zimbabwe are also significant and contribute to the total value of the forest (Bradley, 1992; Campbell, 1993) Campbell *et al* (1991) estimated that households received about Z$1 000/year in replacement value of woodland products. The woodland therefore provided products valuing Z$200/hectare. However, this value may not be realized.

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[8]Godoy, Lubowski & Markandya (1993) review studies estimating the economic value of non-timber forest products and present a method for future valuation.

Even the communal area households themselves seem to substantially undervalue woodland products therefore decreasing their incentive to invest in woodland conservation (Campbell *et al*, 1991). The main problem in this resource issue is the lack of information about the economic and biological aspects of the forests and their *in situ* resources. Considering these aspects may reveal that the *in situ* values of the forest are positive which would support increased conservation.

2.3 THE VALUE OF WILDLIFE

Wildlife resources represent non-timber value through their association with trees which provide wildlife habitat. Wildlife resources provide economic, cultural and ecological benefits (Chimedza, 1989). National benefits accrue through tourism, hunting and international sale of by-products. Wildlife species also play a role in the ecosystem, such as in seed dispersal, soil processes and pest control. From a biodiversity point of view, the potential contribution of wild species is inestimable and could have great value for providing genetic material for breeding or development of pharmaceutical and chemical products (Muir, 1991). Of interest, though, is the use of wildlife in communal areas. Wildlife may be used in the performance of certain rites and traditions. However, more important may be its role in the traditional diet.

Throughout most of Africa, there is evidence suggesting the importance of hunting and gathering in most peasant economies (Asibey, 1974, 1988; Chimedza, 1989; Marks, 1973; Murindagomo, 1988; Murray, 1978; Peters, 1990; Scudder, 1984). In particular, bushmeat still forms a substantial component of protein requirements in some African countries (Martin, 1983; Anadu et al, 1988). While wild food may not

necessarily be a staple food it does provide important supplements and seasonal and emergency substitutes (FAO, 1989). It also provides variety to the diet and improve the tastes. These gathered wild foods often serve as a relish[9] and even if not consumed in large quantities they may be important in contributing minerals and vitamins to the diet. Wild foods may also play an important role during times of food stress or in the diets of poorer households (Campbell, 1987; Bradley & Dewees, 1993; FAO, 1989; Poulsen, 1982; McGregor, 1991; Wilson, 1990). A common use of wildlife, especially insects, is as a snack. Studies often ignore snacks in their surveys, however some studies suggest that snack foods may actually be consumed in large quantities and therefore should not be overlooked.

Nutritionally, wildlife may supplement nutritionally poor diets (FAO, 1989). Table C.3, Appendix C gives the nutritional content of some small wildlife. Most wildlife is comparable to livestock in terms of protein and vitamins while the wildlife tends to be lower in fat. Some wild species such as various rodents even have a higher protein content than domestic livestock. Certain insects are particularly nutritious. Poulsen (1982) likened caterpillars to vitamin pills. A meal of 20 mopane worms supplies the daily requirements of calcium, phosporous, riboflavin and iron for an adult male.

An overview of non-wood forest products in Africa by Keita (1993) found the following evidence supporting the economic and dietary importance of consumption of bushmeat in Africa[10]. Surveys in Bangui, Central African Republic revealed 197 bushmeat traders including 177 women. These traders sell 730 tonnes of meat per year to meet the national consumption of about 25 kg per person per year.

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[9]A relish is served with the staple food for the main meal.

[10]Further studies are discussed in Falconer (1990).

The bushmeat sales of CFAF 37 billion contribute to 10% of GDP. Another study in Bukavu, Zaire found that 72% of population consume bushmeat regularly amounting to about 400 tonnes. Studies in Ghana, Nigeria and Botswana also found reliable evidence on the intake of wild animals. Some pastoralist communities in Botswana are estimated to get 80 % of animal protein from wildlife. Their total consumption of springhare alone is equivalent to 20 000 cattle (Butynski & von Richter, 1974). However, consumption may vary depending on the conditions of the wildlife resources. In Nigeria, a study in an area with no reserve forest and high population density found that bushmeat only contributed 7 % to total meat consumption. But in areas near large forest reserves, 84 % of total meat consumed was bushmeat. Nationally, bushmeat only provides about 7 % of total animal protein in Cote D'Ivoire. However in their tropical moist forest zone this increases to 70 % (Ajayi, 1979).

Further evidence also suggests that wildlife may be important as a source of income (FAO, 1989). A hunter may be able to make more money than could be earned from agricultural production (Asibey, 1988). In Peru, skilled hare hunters in can earn about $ 1 350 per month compared to $ 100 a month as an agricultural labourer. In Ghana, a grasscutter rodent is worth more than twice the daily minimum wage and seven to thirty times this wage in Accra. In fact in Ghana, bushmeat prices tend to be higher than beef or mutton (Asibey, 1988). Table 2.1 shows the market prices of wild and domestic meat in some West African

TABLE 2.1 **Market Prices of Meat in West African Countries.**

US$/kg	1	2	3	4	5	6	7
Hare	3.75	7.20	-	-	-	-	-
African giant rat	-	5.00	-	0.51	2.33	-	-
Grasscutter	-	9.60	3.33	1.06	3.96	10.00	1.00
Brushtailed	4.30	-	3.66	1.06	3.04	-	2.50
Tree Hyrax	-	6.40	-	-	3.66	-	-
Grey Duiker	-	6.80	-	0.88	-	-	4.00
Maxwell's Duiker	-	-	2.83	-	3.75	-	-
Bay Duiker	2.50	-	-	0.86	2.70	-	-
Black Duiker	-	5.20	-	0.79	2.91	-	
Bushbuck	-	5.20	1.33	-	3.07	-	2.50
Bushpig	-	-	3.33	-	3.26	-	2.50
Spot	-	-	-	-	-	3.47	2.50
Red colobus	3.75	-	-	-	-	-	3.00
Civet	1.88	-	-	-	-	3.35	-
Beef	2.50	4.20	-	0.45	-	3.00	2.50
Mutton	3.50	2.80	-	0.61	-	6.00	4.00

1. Cameroon, Sabouang, 1978.
2. Nigeria, Ibadan, 1975.
3. Nigeria, Bendel State, 1977.
4. Ghana, Accra, 1970.
5. Ghana, Accra, 1985.
6. Cote d'Ivoir, Abidjan, 1978.
7. Liberia, Monrovia, 1979.

Source: Asibey (1986)

countries. The prices of the wild meat generally tended to be higher than the domestic meat prices. In Zimbabwe, Murindagomo (1988) found that wild flora and fauna contributed about 60 % to total family income with wild animals accounting for about 74 % of subsistence income.

In Zimbabwe, large game may provide income opportunities through tourism and hunting. However, these animals are illegal to hunt without a license therefore they can not legally be utilized in communal area. The resistance to allowing communal areas control of wildlife resources stems from fears that this will result in overexploitation of wildlife (Muir, 1988a). Despite government control wildlife products do continue to be traded informally and often illegally. Nevertheless, their use and contribution to diet and income, in communal areas, is inhibited. Small wildlife, therefore, may provide greater value to communal households.

Small wildlife resources represent traditional food resources (Chimedza, 1989; Muir, 1988a). They contribute to the tastes, habits and needs of the traditional diet as well as supplementing the agro-ecological situations where they occur (Gomez, 1989). It is hypothesized that small wildlife are an important contribution to the Zimbabwean diet. As well as providing nutritional value, utilization of wildlife as a meat substitute saves income. It can even provide additional income if marketed. Non-use value, such as existence, option, bequest and spiritual value, may also be significant.

The role of wildlife as a food source in Zimbabwe is not well researched and documented (Chimedza, 1989, unpubl; Gomez, 1989; Muir, 1988a; Murindagomo, 1988; Wilson, 1989). Official statistics on household food supplies do not include wildlife consumption (Chimedza, 1989). Researchers also often ignore these resources in their household

studies. However, scattered information is available, usually as a byproduct of other broader studies[11]. Historical evidence first mentioned the role of insects and small game (Baker-Jones, 1956; Carr, 1956, Duncan, 1922). More recent evidence still indicates the use of these resources. Kinsey's (1986) study found that 78.5 % of children consumed hunted and gathered wild food with wildlife contributing the most. This food was consumed as a supplementary food stuff. Wilson (1987) found that people utilized 50 insect species as well as a variety of game. Gomez (1989) compiled a resource inventory of indigenous and traditional foods in Zimbabwe which listed several small wildlife products and also discusses their preparation and use. Chimedza (1989) mentions the importance of small wildlife to household food security in Zimbabwe. A study by Matiza *et al* (1989) found that small wildlife played a small role in coping with food shortages.

Another study by Campbell *et al* (1991) found that 94 % of households used gathered wild foods in their main meals with 92 % of households gathering insects. In one area insects supplied households with 11.4 meals/yr with 1.2 plates/meal and a cost of $0.40/plate. Insects were sold by 5 % of households.

Dewees (1992) mentions insect use by communal area households. Other indirect evidence is found in CASS's (1992) study of the use of indigenous trees which found that 17 species are used for edible insects (Table C.4, Appendix C). The tree species most in demand for use also had the highest percentage of people using them for insects. They also compared present use to use ten years earlier and found that use of trees for insects had declined over time. This decline was attributed to the effects of drought on insect

[11]Table C.2, Appendix C compiles a list of species that have been noted in studies in Zimbabwe.

supply, a decrease in these trees and barriers to access since Independence.

Campbell *et al* (1994) studied woodland resources in two areas in Zimbabwe. They found annual household consumption amounts of 0.5 kg of mopane worms, 157 mice, 12 doves and 649 quelea birds in one area and 0.72 kg of termites in another area. Market prices were $0.50/plate for mopane worms, $0.38/bird, $1/plate of locusts, $0.43/small plate of termites and $0.25 per mouse. In one area quelea sales of $3 913/year for the village accounted for 7.7 % of total household products.

The study of the commercialization of mopane worms by Hobane (1994) documented the collection, processing, consumption and distribution of the mopane worms. The results found that 75 % of households in one area had at least one member collecting while over half of these households had more than one member collecting. While only 10 % collected around their homes, over 81 % collected in the grazing area. People even came from outside the area to collect. Marketing of these worms was considerable with two thirds of households selling within the village. Three quarters of these households sold for cash, earning $40 per 20-25 L bucket, while the remainder traded for goods. Collectors also came from urban areas to purchase the worms to sell in the city.

The most comprehensive documentation of small wildlife use is found in key studies by Chimedza (unpubl.) and Wilson (1990). While Wilson (1990) did not directly study small wildlife use, detailed information on small wildlife use was gathered as part of his diet surveys and overall case study of households. This information is included in his appendix and is a very significant reference on the species consumed, methods of hunting and collection, seasonality, cultural

factors influencing use, as well as information about particular wildlife.

Small wildlife use was however studied specifically in a study by Chimedza (unpubl.) documenting the uses and harvesting techniques of wildlife resources in communal areas. The intent of the study was to raise awareness about the importance of these resources. She found that within the study area, there was a lot of variety in the small wildlife consumed. Mopane worms, termites, flying termites, locusts, cicada, tsambarafuta, crickets and mice were some of the most commonly eaten wildlife. Some men also ate lizards, snakes and frogs, however this was not very common. Results found that 88 % of the households included insects in their diet. While none of the respondents had considered this relevant initially, they later admitted that these insects constituted an important part of their diet. As well as providing an important source of protein and other nutrients, they were relatively cheaper and easier to collect than other foods and the respondents enjoyed eating them. Small wildlife resources were eaten as a relish or snack. They were usually consumed seasonally although they could be preserved if sufficient quantities are collected. Marketing of surplus wildlife was found to occur in about 42 % of the households. Mopane worms were the most commonly marketed followed by rats, termites and crickets. This marketing generally occurred in nearby towns. The women undertook this marketing with the help of their children. The income was used to purchase required food and household items. While men were not involved in the marketing they were however the major clients purchasing. In particular, cooked wildlife was popular as a snack at drinking places. In addition, detailed information on harvesting techniques is found in the study.

Recognition and identification of wildlife food sources followed by systematic studies towards exploiting their potential could lead to development and exploitation of these potentially valuable food resources (Gomez, 1989). By investigating and documenting the wildlife resources, those with promising and proven food potential may be conserved. Technology may also enable increased quality and quantity through selective breeding, and expand utilization (Gomez, 1989). Presently very little time-saving technology has developed to aid wildlife collection because the market value of wildlife is localized and consumption is area specific (Chimedza, 1989). Examination of practices in various areas may however facilitate sharing of improved methods.

However, it has not been clearly determined in Zimbabwe if wildlife could provide a viable economic alternative to other damaging land uses or could provide a complementary activity to other income generating activities (Muir, 1988a). In particular, small wildlife has been ignored. A study by Hobane (1994) on the marketing of mopane worms is probably the first study to look specifically at the marketing of a small wildlife product although some information on small wildlife is included in Campbell *et al* (1991) and Campbell *et al* (1994). Therefore research is needed in Zimbabwe on potential markets for wildlife goods and services. Unfortunately, the bias is against these indigenous products. In the past, colonial administrations tended to support certain products which they produced and consumed, while neglecting the unconventional indigenous resources (Muir, 1991).

However, supply is also changing. Wildlife is decreasing due to increasing population pressure and deforestation in communal areas. In addition, as economic and technological growth debilitates traditional cultural values and food

habits, the use of traditional food resources is decreasing (Gomez, 1989). There is a vast and ancient legacy of knowledge in recognition, identification, collection and preparation of these resources (Gomez, 1989). However, associated with the loss and reduced use of these resources is the loss of this knowledge.

The problem in Zimbabwe is a lack of knowledge about the actual use of wildlife by households and the relationship between the wildlife resources and the forest. Research is necessary in order to understand the value they represent to the people utilizing them. Presently, very little work has been done on wildlife values on communal land (Campbell, 1993). While the value of the wildlife resources may or may not already be recognized by household users, this value is unknown to researchers. There may be the potential for welfare improvements in communities as the value of these resources is revealed. Data on the uses of wildlife resources could be used by researchers to determine the wildlife value. This information about wildlife use and value is necessary for proper management of this resource especially where decisions may involve tradeoffs. There may also be the potential to more effectively market these resources locally as well as further abroad (Muir, 1988a). This could increase local incomes.

The value of the wildlife is especially significant when included in the total timber and non-timber values of trees. These tree resources and subsequently wildlife resources are being seriously affected by population pressure. Therefore management of these resources is of particular concern. Demonstrating the value of wildlife, will contribute to the overall value and importance of the trees.

3.0 THEORETICAL BACKGROUND

3.1 INTRODUCTION

3.1.1 Natural Resource Economics

Natural resources supply us with the materials and energy necessary for every aspect of our life. These resources are particularly important in most developing countries because most of their economy is based on natural resources. However, in developing countries these resources are also important at a household level. The majority of the poor tend to be situated on marginal land which is ecologically fragile and of low agricultural potential. Therefore, these households are depend on natural resources for food and other products for household consumption as well as to sell for income. Often the sustainability of livelihoods of the poor is linked to the sustainability of natural resources and wildlife resources (Swanson & Barbier, 1992).

While this dependency on natural resources may be alleviated by technology and capital in developed countries. Technical substitution may not be possible in developing countries due to capital limitations. As well, physical and social conditions may hinder the adoption of new technology. As a result, solutions for resource degradation may not be simple and conservation may be hard to maintain.

Sustainable development is defined by the World Commission on Environment and Development (1987) as development that '... meets the needs of the present without compromising the ability of future generations to meet their own needs'. Resources cannot be used without considering the tradeoffs involved and the effects of consuming the resources. Decisions therefore need to be made and economics can play a

major role in this decision making process. Economic institutions influence most of our decisions and behavior and are a powerful force in most societies. Therefore economics can also play an important role in the management of natural resources.

Determining a sustainable development path requires economic valuation so that economic and environmental tradeoffs can be evaluated. By determining values for the goods and services provided by natural resources then allocation decisions can be made. Comparison of the benefits and costs of different uses of the natural resource can be used to assess different alternative management regimes. These economic values are therefore important in directing policy decisions and program implementation.

However, incorporation of all aspects of value into an economic framework is not always straight forward. Economic analysis involves considerable abstraction from reality as it serves to provide some clarity in policy prescription. As a result the analysis often involves many assumptions. While, many social as well as biological factors are usually involved, these may be difficult to translate into an economic measure. There are also externalities, positive or negative, that arise from actions. These are also difficult to account for in valuing natural resource. Therefore the value may not be representative and may actually distort decisions.

Nevertheless, economics still plays a vital and useful role in managing natural resources. The challenge is to develop methods of valuing the natural resources that capture as much of the value as possible. While technology may not easily be transferred from developed to developing country, the same may also be true for valuation methods and management schemes. Different economic, environmental and

social issues will affect the applicability of these methods in a developing country.

In Zimbabwe, natural resource valuation has not been adequately dealt with (Bojo, 1993; Campbell *et al*, 1991b; Moyo *et al*, 1992). However this valuation is needed for land allocation and use decisions (Bojo, 1993; Moyo *et al*, 1992; Scoones *et al*, 1992a). Knowledge about the underlying theoretical factors is necessary so that this valuation can be adapted and applied to a wide variety of issues including the valuation of wildlife resources.

3.1.2 Welfare Economics

The basis for valuation is in Welfare Economics. Welfare economics focuses on society's production of goods and services and the distribution of these goods and services and income among the members of the society. Applied welfare economics is based upon measures of change in an individual's well-being in different situations. The situations represent different bundles of goods that are consumed. From the individual's measure of change, an aggregate welfare change is derived for the entire society. This aggregation, however requires approximations and value judgements to make the measures empirically applicable (Boadway & Bruce, 1984).

Welfare economics is important as it forms the basis for policy decisions. However, with any decisions, there are usually tradeoffs resulting in both benefits and costs. The object of welfare economics is to determine the net social benefits of a change and the distribution of the benefits and costs.

Two key economic axioms underlie welfare economics. The first and most basic is that when economic agents such as individuals or households are presented with a choice

between bundles of goods, they have a preference for one bundle over another. The second major axiom is that an economic agent will attempt to maximize its overall level of satisfaction or utility through actions or choices. Additional axioms of non-satiation and transitivity assume that more is always better therefore an economic agent will always choose more and that if bundle A is preferred to bundle B and bundle B is preferred to bundle C then bundle A is always preferred to bundle C. These assumptions lead to some powerful predictions about behavior of economic agents in different situations.

Comparisons in welfare decisions involve the concept of utility. Utility is a concept incorporating individual preferences of consumption and the level of satisfaction derived from these consumption choices. An indifference curve is formed by the possible combinations of consumption of various goods and services for an individual that yield an arbitrary utility level.

However, utility is not cardinally measurable. Observing household choices between different alternatives only reveals ordinal ranking. Therefore comparing utility between different people is difficult because utility has no measurable units. A monetary measure or monetary equivalent of utility is needed.

However, the allocation of resources between individuals can be represented by a Utility Possibility Frontier[1]. Any point within the frontier is inefficient because utility can be gained by moving to the boundary of the frontier. According to the Pareto Principle, any point on the curve will be Pareto improving because at least one person will be better off and no one is worse off. All points on the curve are therefore Pareto optimal because no further change can

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[1]For diagrams see Boadway & Bruce (1984).

be made without someone being worse off. However, in reality most changes are not Pareto improving because someone is worse off. Also, the Pareto Principle still does not indicate which point on the curve is best. Different points on the curve will have different income implications. The issue of income distribution remains a great difficulty in welfare economics.

The Kaldor-Hicks Compensation Principle was developed to deal with the impracticality of the Pareto criterion. According to the compensation principle, welfare is improved if the gainers can compensate the losers and the gainers are still better off. However, the compensation does not actually have to be paid because it is the net benefits that count. Therefore the actual affects of the income distribution are ignored.

A possible approach is the Social Welfare Function[2]. The social welfare function is a social utility function that represents the aggregate well-being of the society. The social indifference curve therefore represents all the allocations of utility within the society for a given level of social satisfaction. By choosing the highest social indifference curve within the utility possibility frontier, social welfare is maximized. However, deriving social welfare functions remains a problem. Arrow (1967) and several others have suggested that a Social Welfare Function can not exist in a democratic society.

However, by using a special form of the social indifference curve, Maximum Value of Social Product (MVSP) criterion can be utilized (Randall, 1987). In this case, the social indifference curve is a straight line which weights each dollar of income equally regardless of who it accrues to. From the curve the value of the society's output can be

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[2]For further reference and diagrams see Randall (1987).

calculated without distributional weights and the policy that favours the MVSP will result. Any points above the social indifference curve and within the Utility Possibilities Frontier are seen as improvements according to MVSP. The optimal solution is at the point of tangency of the highest feasible social indifference curve and the Utility Possibilities Frontier.

While an improvement through MVSP criterion may not necessarily be a movement towards efficiency, it must still be efficient. Also, an optimal solution is permissible as long as the economic benefits to the gainers exceed the costs to the losers. As a result, income distribution is not an issue. MVSP criterion implements utilitarian criterion of trying to achieve the greatest benefits for the most people. However, while MVSP criterion is widely applied to many types of policy decisions, it can not be applied to all policy decisions.

Welfare measures can be estimated using demand curves. With Hicksian or "utility-held-constant" demand curves, points on the curve represent the quantities demanded at various prices while holding utility constant. Compensating and equivalent variation are the measures of welfare under the Hicksian demand curve. Compensating variation is the amount of income that would be taken away from the household in the new situation so that they are at the same utility level. In other words it is the maximum amount of dollars that the household is willing to give up to have the change occur. Equivalent variation, however, is the amount of income that must be added to the initial situation to achieve a new utility level. It is the minimum amount of income that a household is willing to accept to forego a move. Compensating and equivalent variation can be measured by asking Willingness to Pay and Willingness to Accept questions through Contingent Valuation.

The Marshallian or ordinary demand curve is an approximation of the Hicksian demand curve. The Marshallian demand curve however is observable. This demand curve holds income rather than utility constant. One price is changed while other prices and income remain constant. Consumer surplus as estimated under the Marshallian demand curve is frequently used as a measure of welfare. This consumer surplus can be measured using Travel Cost Modeling and Hedonic Price Modeling.

3.1.3 Economic Value

Before proceeding with any discussion of valuation it is first necessary to define economic value. A measure of economic value is that amount of money that an individual is willing to exchange for a good from a set of resources or alternatively the amount of money that an individual would accept in exchange for the good (Adamowicz, 1991). Embodied in that economic value are several components. These components include the individual's ability to pay; the value placed on the final outcome and the perception of how the good will contribute to this outcome; and the availability, desirability, and price of alternatives (Peterson *et al*, 1990).

Prices approximate the value of a resource in exchange (Chopra, 1993). However, due to market imperfections and other factors, the exchange value may not represent its value in use[3]. Exchange value may not even exist for certain resources, such as those that are person or group specific, yet these resources may have high use value. Also, users with limited access to cash, such as subsistence users in developing countries, may not be able to offer a high exchange value. Yet to these users these resources may have a high assigned value. This value may then be captured

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[3]Smith (1937) explains the difference between exchange and use value.

in their non-cash transactions. Exchange value derived from these transactions though may differ from the exchange value when the resource is sold in less imperfect markets.

The value of a natural resource includes both marketed and non-marketed values that arise from the use or even non-use of the natural resource (Pearce, 1993). Use value includes direct and indirect use values. Non-use values includes existence value as well as its sub-components option and bequest value, and quasi-option value.

Use value of a natural resource results from direct and indirect use of the goods and services of a natural resource. A direct use of wildlife includes activities such as harvesting for wildlife products (ie. hunting/trapping) and birdwatching. Direct uses may be consumptive such as with hunting or non-consumptive as with birdwatching. Consumptive use differs from non-consumptive use in that it results in the extraction or harvest of the natural resource. Non-consumptive use however allows use of the natural resource often without altering significantly its availability for future use. Indirect use is obtained from the ecological functions of the species ie. species role in the ecosystem.

Non-use values are thought to represent a significant portion of TEV. The difficulty is that all these non-use values are intangible. They are difficult to grasp let alone value. Nevertheless they should be recognized and included in TEV. Otherwise overexploitation may occur to gain direct use value while ignoring the other values. Existence value is the value obtained by an individual from knowing that a natural resource exists even if the individual may never see or use the resource. This value is motivated by altruism or caring for other people or beings. The resource may be seen as having value through being a unique asset. It may also have intrinsic and "stewardship"

value as well as being a cultural asset. Existence value may also include the value that individuals place on retaining a natural resource for future uses that may not even yet be discovered or obvious. Bequest value is the value of conserving a natural resource so that it is available for future generations. Individuals feel that they want to retain a natural resource so that their children may also derive use and non-use value from that natural resource. The question may be when is it appropriate to take these values into account? If the goal of society is to allocate natural resources to maximize the utility of the individuals in the society then it should be appropriate to include existence values since they are altruistically based (Pearce and Turner, 1990).

Irreversibility and uncertainty are crucial issues with quasi-option value. Irreversible damage may occur with lack of conservation where use of a resource results in its permanent decline or degradation. An example is with wildlife populations which must retain a certain minimum viable breeding population or else they become extinct. If depletion of the natural resource is irreversible then any future options are therefore eliminated. Uncertainty about the future means that there may be unknown foregone future benefits of eliminating a natural resource. The resource may be needed in the future or may become of great value due to an undiscovered use. Therefore quasi-option value represents the individual's desire to prevent irreversible damage which would eliminate future known and unknown use of the resource.

While it is desirable to derive total value for a resource, it may be difficult. Many of the components of this total value have no market, such as non-consumptive use, indirect use and non-use of wildlife. Also, in developing countries, markets may be weak or non-existent for certain products.

Even direct use of wildlife in a subsistence community may not involve a market if all consumption is within the household with no external buying or selling. Subsistence use, may not involve money transactions but still represent great value to the household in terms of nutrition and saved income. Different estimates of values of wildlife and wildlife products in various developing countries have uncovered significant values[4].

If the market system is less developed, the concepts of value may be harder to determine in currency amounts. In developed countries different methods of valuation have been developed. However these methods are based on the assumption that the individual is very familiar with market systems and therefore can state reasonable estimates of values for certain goods and services. This assumption however may not hold in developing countries where economic systems may differ. Recognition of the differences between economic systems where the research was developed and an understanding of the economic system where it is to be applied is essential if any relevant values are to be obtained. Through adaptation, these methods may still be applicable to the developing country situation.

3.1.4 Household Production Function

Household production theory is a conceptual method for evaluation of households by modelling the decision-making process within the household. This model then provides a stepping stone for implementing empirical valuation methods for specific products. Through an integration of firm and consumer theory, the household is seen as a decision-making unit that must make production and consumption decisions that maximize utility while faced with production and income constraints. Household production function theory plays two

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[4]See Table 2.1 in Swanson & Barbier (1992).

roles (Braden & Kolstad, 1991). First, it organizes a scenario so that the analyst can incorporate existing empirical information about how people use their resources. This framework may suggest how empirical insights can be used. Second, household production theory provides a rationale for grouping private commodities with non-marketed goods and imposing restrictions on the interrelationships between the goods. These restrictions are explained in terms of preferences[5].

While the theory has generally been applied to the consumption of market goods, it can also be applied to non-market goods or public goods such as natural resources. An application requires reinterpreting prior restrictions on the preferences used to estimate the demand for a non-market good. These restrictions can then be incorporated into household production theory (Smith, 1990). Household production theory helps identify potential linkages between market goods and non-market, environmental goods (Braden & Kolstad, 1991). As well, it may offer qualitative insights into empirical methods that could be attempted.

Through adaptation, household production theory can also be used to model households in developing countries. Agricultural households, which dominate in developing countries, must make production decisions as well as consumption decisions and these decisions must be integrated. Household production theory, by nature, merges production and consumption theory and is therefore quite appropriate for application in developing countries. However, it must be recognized that there are differences between household composition and behavior in developing countries and those in developed countries where much of the household production theory has been applied.

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[5]These restrictions are further explained in Braden & Kolstad (1991).

The following discussion will attempt to mesh classic household production theory and natural resource theory. Household production theory will be discussed in terms of its application to marketed and non-marketed natural resource goods and exemplified through a household model. The merging of natural resource theory and classic household production theory into a developing country household model will be demonstrated, as wildlife valuation is incorporated into a Zimbabwean agricultural household model in Chapter six.

Household production theory developed through the integration of the theory of the consumer with that of the firm. This integrated theory was then applied to households. Through Household Production theory, assumptions on preferences and constraints faced by households could be incorporated into models of household behavior.

The household production theory approach postulates that the household obtains utility from nonmarket commodities (bundles of characteristics or attributes) that are produced in the household from inputs of private and public goods, household resources and available time. This production can be explained as a two stage optimization problem. The production decision involves minimizing the cost of producing the nonmarket good. The consumer decision involves maximizing utility through choice of goods.

First consider the production problem. The household produces an output vector, **Z**, consisting of many utility-yielding, nonmarket goods or services, **z**. Vector **Z** is produced from a vector of inputs **G** (private goods, **g1**, and public goods, **g2**), a vector of labor inputs, **L** (where **l1** is labour supplied to market and **l2** is the labour spent in household production), and a vector of capital inputs, **K**.

This production function is presented as:

$$Z = f(G,L,K) \qquad (1)$$

The objective is to minimize the short run cost, $c = P_G*G + P_L*L$ where P_G is the vector of prices for the good vector G and P_L is the wage rate of labor, L, subject to technology and time[6] constraints given Z and K. The result is the cost function:

$$C = f(P_G,P_L,Z;K). \qquad (2)$$

The solution is at the point where C is "full income". The "full" income constraint involves time and money resources. "Full" income is the total time, T, of each household member valued at the appropriate wage plus net income from sources other than labour. The cost function is positive, linear, homogeneous and concave in P_G and P_L, increasing in Z and non-increasing in K.

Now consider the consumer decision. The household has the following utility function:

$$U = U(q_1,q_2,Z) \qquad (3)$$

The household will maximize U subject to the budget constraint $Y = p_1g_1 + p_2g_2$ (where Y is household income, p_1 is the price of g_1 and p_2 is the price of g_2) and also subject to the supply of inputs, g_1 and g_2.

The production decision appears on the production possibility frontier (ppf). The ppf gives the largest combinations of two non-market goods, z_1 and z_2, that can be produced with a given budget. The production decision is a

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[6]The treatment of time is important. If T is a vector of time endowments, then T - L = E, the leisure vector and can be implicitly treated as part of Z (Deaton & Muellbauer, 1980)

cost minimization problem in which the cost function defines the ppf. At a point on the ppf the marginal rate of transformation, m^o between the outputs is the ratio of the marginal costs of the output of z_2 to z_1. These marginal costs are termed the shadow costs or shadow prices of the outputs. Given the ppf, the household makes its consumer decision in choosing the combination of the goods, z_1 and z_2, that maximizes utility, U. This point, z^o is where the highest indifference curve, u_1, is tangent to the ppf.

The household production function approach can be used to estimate the value of a change in a natural resource by investigating the change in the consumption of commodities that are substitutes or complements for the natural resource (Braden & Kolstad, 1991). The marginal willingness to pay for a public natural resource, q_2, can be calculated once the demand function $q_1 = q_1(p_1, Y, q_2)$ is estimated, if the production function (equation 1) is known. Generally though, the functional form of the household production function is unknown. However, by making assumptions about certain broad characteristics of the production function, such as whether inputs are substitutes or complements or whether an input is essential or not, then it is possible to calculate the marginal willingness to pay for z from market data (Maler, 1981).

Household production theory is valuable because it can be used to bring preferences for nonmarket goods and services into the arena of observable market relationships. From this model, actual behavior serves as the basis of valuation so familiar types of data and analysis can be employed. However, weak complementarity and weak substitutability must hold for the measures to be valid and complete. A criticism of the household production model is that the household is seen as a homogeneous, monogamous, nuclear unit (Fapohunda, 1988). Therefore tastes are seen to be uniform among family

members, and these tastes are also assumed to be historically stable so any behavioral changes are attributed to income and price changes. The model also typically ignores the internal distribution of goods and services and instead pools these resources. However, in developing countries many of the commodities consumed may be produced within the household and income may consist of income in kind and extended family transfers. Social scientists argue that the homogeneous household model is insufficient because intra-household interactions are important in socioeconomic processes. Gender-specific income earning, decision-making and expenditures could influence decisions.

3.2 NON-MARKET VALUATION METHODS

3.2.1 Introduction

Non-market valuation derives a money-based valuation of changes in quality or quantity of a good or service, typically not priced in a market. The two main approaches to this valuation include the Inferential or Indirect approach and the Direct approach. The Inferential approach encompasses Travel Cost Modelling and Hedonic Price Modelling, while Contingent Valuation uses the Direct approach.

Inferential methods differ from direct methods in that they rely on observation of existing behavior, usually market behavior (Adamowicz, 1992). The value of the non-market amenity is inferred from market data for another good which has an estimatable linkage and consumers make an actual market choice (ie. decide to go on a trip or buy a house) (Mitchell & Carson, 1989). With inferential methods, a model is derived and tested with observable data. This method assumes weak complimentarity therefore the

environmental good or service has a market price associated with it (ie. trip costs, property value, etc.). It is also assumed that if none is consumed then there is no demand. Because this type of valuation relates the value of the good to the market it measures use value however it can not be used to elicit non-use values.

Contingent Valuation unlike the inferential methods does not look at behavior. Instead, a situation is presented and individuals are asked to value the good. In this way individuals are placed in a hypothetical market situation. Instead of making assumptions about behavior, as with the inferential methods, CV incorporates the individual's perceptions and decision-making process into the valuation process (Adamowicz, 1992). CV is currently the only method available for measuring non-use values.

3.2.2 Travel Cost Modeling

Travel Cost Modeling (TCM)[7] has generally been employed in developed countries to value recreational activities. Some applications can also value quality changes in the environment which affect recreational activities. The Household Production Function is the basis for TCM. Travel expenditure to reach the recreational site is interpreted as an estimate of the benefits from the recreational experience (Pearce, 1993). To gather this information, a survey is used which looks at days spent, distance travelled, and expenses resulting from this visit. From this information, a relationship between distance and expense is derived.

There are several variations of TCM. The Basic TCM is used to value a recreational site by using travel costs as a proxy for the price of visits to a particular recreational site. People are surveyed about their travel, distance,

[7]This section is based on Adamowicz (1992). For further reference also see Mitchell & Carson (1989)

time and expenses as these can be seen to represent the value to that person of visiting a particular site. This value is expressed as a regression of the number of visits to a site on the cost of travel and time to the site. However, this model has some assumptions that may not be correct. It is assumed that the individual determines the number of trips to a site at the beginning of the season. It also is site specific and ignores the influence of substitute sites. While direct recreational benefits can be valued, some esthetic benefits and ecosystem use can not be examined. Another major disadvantage of the basic TCM is that because cross-sectional data is used, temporal site quality changes are not recognized. However, the majority of interest in recreation requires valuation of quality changes. As a result, a number of variants to the basic approach have been introduced. These variants include the Varying Parameter Model, the Hedonic TCM and the Discrete choice or Random Choice Models.

The varying parameter model applies the basic TCM across a number of sites and looks at attributes from the site to provide estimates of the value of quality changes (Smith & Desvouges, 1986). However, the underlying behavioral model is unclear. Also, the possibility of substitution between sites and how to define relevant sites is unclear.

The Hedonic TCM represents another approach. Individuals are assumed to be WTP more to visit sites of higher quality. Therefore this will be evident in higher travel costs. By using information on site attributes and individual choices, the implicit price of quality attributes is found based on the change in travel cost with a change in quality attributes. However, the model also has theoretical and empirical problems such as difficulty in defining sites and the potential for negative pricing.

The Discrete Choice Model/Random Utility Model (RUM) is used to value a change in site quality by analyzing recreational site choice with respect to site attributes and travel cost and individual characteristics. In this model, several sites are presented to the individual and they are assumed to choose the site that yields the highest utility. Trip choices are assumed to be made independently over the season and that substitution between sites may occur. This model can be used to look at complex behavioural processes (such as nested choice processes) and can also be used to derive compensating or equivalent variation. This model has been applied in a number of studies[8].

The advantages of TCM are that values are derived from observations of past behavior not intentions or attitudes, a behavioral model is provided and its accuracy can be tested and a set of testable hypotheses are produced. However, a disadvantage is that since the behavioural model is specified by the researcher it may not actually reflect the actual decision-making structure. Also the choice process can not be fully described by travel costs and site attributes because individuals also have spatial perceptions that are not measurable like distance (Fletcher et al, 1990). Time constraint and value may play an important role in site choice. However, the issue of the value of time has yet to be determined. Finally a main limitation is that TCM can only be applied to measure use value, however direct commercial use and non-use values are ignored.

3.2.3 Hedonic Price Modeling

Hedonic Price Modeling (HPM)[9] attempts to estimate an implicit price for environmental attributes by looking at real markets in which these characteristics are effectively

[8]See Adamowicz (1992).

[9]For further reference see Braden & Kolstad (1991), Mitchell & Carson (1989)

traded (Pearce, 1993). Hedonic house or land pricing is used to value environmental services through property values. The environmental attributes of the area are reflected in the house or land price. Therefore this method attempts to incorporate market and non-market aspects of a good in the market price (Adamowicz, 1992). However, this method also assumes that property owners are aware of the environmental variables in their area and respond. HPM has primarily been used in evaluating air quality and noise levels.

HPM is done by gathering cross-sectional data on housing sales or estimates of house prices in the area. Data is also gathered on the factors that are likely to influence the prices or sales. Multiple regression is then used to estimate an implicit price.

Problems with HPM involve obtaining sufficient and controlled data. Also true functional forms are unknown. HPM also involves many assumptions that may be difficult to meet. Prices are assumed to reflect equilibrium conditions within the market. Simultaneous changes in substitute sites are difficult to value. As well, buyers and sellers must have full information on the market and non-market goods. While expectations about changes are implicit in prices, these can not be observed. Also, property transactions are seen as costless. There are also assumptions regarding preferences for attributes and variations in bids for different levels of attributes. Nevertheless, HPM does provide an alternative to look at the effects of environmental change on value.

3.3 CONTINGENT VALUATION

3.3.1 Introduction

Proposed by Ciriacy-Wantrup in 1952 and applied by Davis in 1963, Contingent Valuation [10](CV) has continued to develop and play an important role in valuation of non-market goods. The number of CV studies and body of research into CV itself has expanded and evolved to include over 1600 citations and in fact comprises the fastest-growing literature on non-market valuation. Few of these studies, however, have been done in developing countries.

Today CV remains an important method to value non-market goods, especially as it can be used to derive non-use as well as use value. With increasing environmental concern, policy makers in developed and developing countries need value estimates of environmental goods. CV plays an important role in estimating these values as it often is the only means of obtaining these values. CV is still the focus of ongoing research and debates and remains an evolving and significant tool.

CV is a survey-based technique which is commonly employed to derive non-market values. This method measures peoples' preferences in hypothetical situations which create artificial markets. Respondents are presented with a scenario, description of the amenity to be valued, a hypothetical payment vehicle and a question to assess their Willingness-To-Pay (WTP) or alternatively their Willingness-To-Accept-Compensation (WTA) for the outcome of the scenario. The individual's response to the WTP or WTA question represents the theoretical welfare measure or their value for that amenity. CV studies implicitly assume that people are capable of responding to questions on value

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[10]For further reference see Adamowicz (1992).

because they fully understand their preferences and are familiar with the concept of value through exposure to prices, trade, and consumption of marketed goods ie. market exposure.

Different variants of the CV technique have been employed to ask the WTP or WTA questions. Open-ended CV questions directly ask the individual to choose a value from a range of values or simply to express their own value. Other mechanisms provide benchmarks for the individual regarding their spending on similar goods and services.

Closed-ended CV questions differ in that the individual is not asked to determine a value. Instead they are presented with a value which they either accept or reject. The value is varied across the sample of individuals. The probability of acceptance of different bids is then used to build a statistical model and determine the expected value of the bid. Variants of closed-ended questions include bidding games which lead the individual towards a maximum WTP. A series of bids are proposed with the respondent rejecting or accepting each bid before considering the next. Another approach is to present several questions with varying attribute levels or goods. Alternatively, the individual may be presented with different packages of quality attributes and payments and asked to vote on each. This information can then be used to look at the impact of changes. Abbreviated bidding procedure with follow-up is a combination of a bidding game followed by an open-ended question.

The referendum approach, a variation of CV, applies a political market model instead of a private goods market model. By voting in referenda the citizen makes a binding decision about the provision of a public good (which may be paid through tax mechanisms). The basis is that private goods and political markets exist to coordinate the exchange

of goods and services between agents. If both markets are driven by identical individual demand curves for the good then WTP and WTA should be identical. The outcome in the private goods market is the equilibrium price where demand intersects supply and is therefore Pareto optimal. By voting, the majority who want the public good are able to force the minority who may not want the good to pay for it also.

The various CV approaches must satisfy certain assumptions. The individual must fully understand the current quality or level of the goods or service being valued, the change in the quality or quantity of the good or service, the time element, method of payment and what the payment amount actually represents (ie. maximum WTP). This requires an accurate description of the situation in the survey.

The advantage of CV is that it can be applied to a variety of situations in which data is limited (Andersson & Bojo, 1990). This is especially important in the case of non-market goods where there is no market value. Evidence on CV has both supported and criticized the use of CV. However, CV is presently the only method available to attempt to measure non-use values such as existence, bequest and option values.

3.3.2 Theoretical Basis

The theoretical basis behind Contingent Valuation is in welfare economics[11]. The axioms underlying welfare economics[12] have important implications for CV. When faced with an initial endowment of resources, the economic agent will trade until the highest level of utility is achieved. The optimal point is at the point of tangency between the utility possibility frontier and the social welfare

[11]Mitchell & Carson (1989).

[12]These axioms are mentioned earlier.

function. Because the social welfare function cannot be derived, Pareto criterion is used. Therefore movements towards the utility possibility frontier are improvements and all points on the frontier are optimal. CV attempts to provide information so benefits can be assessed according to Pareto criterion.

CV is consistent with consumer sovereignty in that it allows consumers to be the judge of what gives them utility. The value of a good can be defined as the most that the agent is willing to exchange for that good, or the most the agent is willing to accept to give up that good. While the value depends on the initial endowment it also is defined in relation to the overall economic system. CV can then be used to determine distributional information with respect to resources.

The choice of WTP or WTA in CV depends on which welfare measure is desired. While theory suggests that there should be no difference between WTP and WTA, evidence from studies have indicated otherwise. Many studies have tried to determine how much difference there is between these two measures.

Knetsch along with others (Knetsch, 1990; Knetsch & Sinden, 1984; 1987) have found that WTP and WTA values are not similar. Bishop and Heberlein (1979, 1980, 1984, 1986) applied the CV format to situations where the respondents actually had to buy and sell real goods using real dollars. Their studies also found large differences between WTP and WTA which could not be attributed to the hypothetical nature of CV. These studies did reveal that there was a difference between the way respondents reacted to the different questions so the difference in amount was actually a methodological artifact. WTP and WTA bids are expected to differ with 'unique' public goods because the elasticity of

substitution between the unique good and market goods would be very low or zero (Hanemann, 1991).

A number of hypotheses have emerged attempting to explain why WTA and WTP differ. However, Mitchell and Carson (1989) conclude that a combination of factors included in these hypotheses are involved. They suggest that it may be possible to determine WTA with a carefully designed survey, such as a referendum format, although it is difficult. However, they believe that WTP is the correct measure of valuing decreases in a good. Even in cases where WTA may be the most appropriate measure, such as in environmental damage, WTP is more commonly used because WTA is difficult to elicit.

After determining the correct theoretical measure for a sample of individuals there is the question of aggregation of the results to obtain the total benefits of the good. Samuelson (1954) produced a seminal article on public good which determined that the correct method was to sum the individual demand curves vertically rather than horizontally as with private goods. Randall *et al* (1974) were the first to use an expanded framework of Samuelson's work, to form the basis for most subsequent CV studies.

Another issue of aggregation involves aggregation of subcomponents of a benefit. Studies show that independently measured components can not be aggregated in most situations without overcounting (Hoehn, 1983; Randall, Hoehn & Tolley, 1981). Also, the sequence in which the subcomponents are presented to the respondent will influence the value they give.

Although CV is widely used it does have its liabilities. Quality of this approach may be affected by hypothetical, strategic, information, starting point and vehicle biases (Cummings et al, 1986; Mitchell & Carson, 1989). The main

skepticism of the CV method is its hypothetical nature. The individual does not actually have to pay the amount they state therefore there is no real check on if this is the value they truly would pay. The individual's payment may depend on if they take the valuation exercise seriously or if the individual feels the response will be influential (Randall, 1987). While traditional economic theory predicts that these values should not deviate, empirical evidence has consistently revealed three to ten fold differences. The landmark study by Bishop and Heberlein (1979) compared WTP from CV studies with actual cash outlays. This study found that the sources of bias mentioned above, particularly hypothetical bias do have significant impacts on CV values. However, other studies found little significant difference suggesting that the CV values represent true values. Kealy et al (1988) and Dickie et al (1987) found that differences in expenditures between hypothetical and actual markets do exist. These studies used CV to find use value for market goods that the respondent was well acquainted with purchasing. Bishop and Heberlein (1979) suggested that if properly structured there is no significant difference between the hypothetical value and the value the individuals would actually would pay. Smith (1992) stresses that the good to be valued must be framed to reflect how people perceive the good including substitutes or complements and how people understand the effect of a change in the good on their consumption bundle.

Another concern is that the individual may see the survey as an opportunity to behave strategically through their responses. Strategic bias occurs when respondents feel they can influence an investment or policy decision through their answer. They may overstate of understate their true WTP or WTA estimates. However, evidence from highly structured experiments in developed countries fails to support the hypothesis that respondents will behave strategically.

(Arrow, 1986; Bohm, 1972; Mitchell & Carson, 1989; Scherr & Babb, 1975; and Smith, 1977).

Another form of strategic behavior involves the "free rider" issue if the good is a public good (Pearce & Turner, 1990). In the case of a project the individual may not be WTP because they feel government should pay for the project or that others would pay anyway. However, the limited research does suggest that this is not common (Cummings et al, 1986; Mitchell and Carson, 1989).

Information bias can also occur since knowledge plays a major role in influencing people's attitudes and behavior. Therefore information about the good or service in question may influence the value an individual places on it. Randall and Stoll (1983) found that small increments in information produced large shifts in existence value. They concluded that existence value is quite volatile when new information is provided. Further studies have also considered the effects of information (Kopp, 1992; Rondeau, Rollins & Martin, 1993). The positive influence of information on WTP is also supported in other empirical studies (Bergstrom, Stoll & Randall, 1990; Hoevenagel and van der Linden, 1993; Samples, Dixon & Gowen, 1986; and Whitehead & Blomquist, 1991). Although research by Boyle (1989) found that small increments in information may have no impact on valuation of a good. Mitchell and Carson (1989) acknowledge that knowledge and information about the good or service being valued is an important component of CV.

The bidding game format may also introduce starting point bias. The respondent is presented with an initial bid followed by other bids and may then also be asked to state their own value. However, the respondent may be unsure and therefore take the initial bid as a clue to the 'correct' bid which would affect their stated WTP. The design of the survey therefore plays an important role in the accuracy of

the response. The way the interview is conducted or sequence of the questions may influence response (Mitchell & Carson, 1989). Also, the structure of the questions may imply value cues through starting points, anchors on values, and ranges. By introducing a starting point there is the possibility of influencing the individual by suggesting a range or causing them to accept an early bid in order to keep the bidding game short (Pearce & Turner, 1990). The vehicle or choice of payment may also influence response as individual may be sensitive to certain vehicles such as taxes or higher prices (Pearce & Turner, 1990).

Finally there is the issue of embedding brought to attention by Kahneman & Knetsch (1992). Embedding results when values are dependent on whether the amenity is evaluated individually or as part of a more inclusive category. Embedding occurs when the value of a subset of goods does not differ from the value of the entire set. Therefore, it is important to be aware of the range of commodities which respondents may consider related to the amenity being valued.

There is the question of the validity of verification methods. Verification studies usually only compare two different groups - consumers and the survey group. Also, these studies do not test the accuracy of CV when applied to non-use or non-market values. However, determining these values represents the most important application of CV. An approach suggested by Adamowicz (1988) to test non-market values against market values is to examine the validity of the CV value in terms of the entire bundle of goods that a consumer would purchase under the related utility function ie. Is the WTP for a certain resource rational in terms of income?

The task is to determine if the value derived from CV analysis is appropriate in an economic context and is a

reasonable estimation. This is particularly important when these values play a role in decision-making. Perhaps, this question of accuracy can not be resolved in a general context but must be considered with every individual application using the appropriate evidence from past studies. The Arrow-Solow panel established by the US National Oceanic and Atmospheric Administration to pass judgement on CV for use in litigation found that CV was reliable and produced relevant values when used appropriately and with carefully designed surveys (Arrow et al, 1993). Bishop & Heberlein (1979) suggest that while CV is inaccurate even under the best circumstances, it still is useful in producing policy-relevant values if properly applied in suitable situations[13].

While evidence supports use of CV, it is still controversial and several studies found in Cambridge Economics Inc. (1992) discredit this approach. Peterson and Peterson (1993) question the validity of these nonmarket valuation attempts. Kelman (1990) also suggests several reasons to oppose efforts to value nonmarket benefits and costs. He feels that pricelessness itself signifies value and to impute a price lessens this value. Kahneman & Knetsch (1992) even suggest that the value achieved by CV does not represent the value of the amenity for a public good but also incorporates the amount people are WTP to achieve moral satisfaction.

3.3.3 Applications in Developing Countries

While Contingent Valuation has been extensively applied and tested in developed countries, its application in developing countries has been very limited. Markets and knowledge of values may not be as easily defined in a developing country. Differences in economic structure and individuals' concepts

[13]While CV has been successfully defended and used in North America and increasingly in Europe, it is still not accepted everywhere such as in Australia.

of values may significantly differ from those in developed questions. These differences may render these techniques invalid. However, the few studies that have been done have had promising results and suggest that CV can be applied in a developing country.

CV has been applied in developing countries to problems of financing education (Thobani, 1983; Tan, Lee & Mingat, 1984; Jiminez, 1987), as well as to health (Jiminez, 1987; Birdsall, 1987), the water sector (Boadu, 1992; Briscoe *et al*, 1990; Hsu & Li, 1990; Whittington, 1990; Whittington *et al*, 1987, 1990 a, b, 1991, 1992; The World Bank Water Demand Research Team, 1993), sanitation services (Whittington *et al*, 1993) and national parks (Abala, 1987; Shyamsundar & Kramer, 1993). Further studies have also supported the application of CV (Altaf *et al*, 1993; Bohn *et al*, 1993; Campbell *et al*, 1991; Singh *et al*, 1993). Whittington *et al* have tested the applicability and accuracy of CV methods in several of their studies. These studies found that CV was practical and feasible.

Factors that may affect application include accuracy of the household information that can be obtained, and survey design considerations such as questionnaire format and relevant terms of payment. As well, there is the possibility of strategic, starting point and hypothetical bias. Therefore, CV needs to be analyzed in terms of the cultural and economic situation being studied.

Household information, such as income and expenditure or even ages, may not be as easy to obtain in a developing country as in developed countries. In developed countries people are often required to supply personal and business information through applications, tax forms and regular census questionnaires. Therefore people keep detailed records of personal and business information. This information does not necessarily have the same importance in

developing countries. Inferences may need to be made or alternative measures may have to be substituted. In fact the researcher may have to become creative in order to derive the information necessary.

Accurate information on household income may be hard to determine due to a lack of records. In fact, Whittington *et al* (1990) felt that questions about income may even cause antagonism. In order to derive a measure of income they developed an ordinal measure of the value of household assets. This value was based on a series of observations about construction of the house, and household possessions. This value was supplemented with two other income indicators, remittances and the occupation of principal members of the household to derive their income value. In another study by Whittington *et al* (1992) in a different country they also faced difficulties obtaining income information. Instead they again opted for indirect measures. Where farmers were unable to recall agricultural income, Boadu (1992) calculated the farm income based on acreage and crop budgets from the Ministry of Agriculture for that region. In a study of water supplies in Brazil, Briscoe et al (1990) used the number of domestic electrical appliances that the household owned as the best measure of accumulated assets.

Collecting accurate and detailed expenditure accounts may also be difficult. These often require long study periods and close monitoring. However, they have been successfully conducted in developing countries.

While age seems like an easy factor to establish, it may actually prove to be difficult, particularly in the case of adults. Age may not be well recorded. However da Corta & Venkateshwarlu (1993) found in their study in India that the timing of an event in the family history (such as births or marriage) could be determined by relating it to a major

event. Therefore they compiled a chronology of local events that could be used as reference points.

As well as considerations involving collection of information, the actual design of the survey is also important. The first issue is whether the purpose of the survey is to establish WTP or WTA. Boadu (1992, p.458) points out that 'a blanket application of CV without consideration of equity and the ability of households to pay may defeat the purpose and usefulness of the method'. WTP and WTA could be different based on income therefore the research needs to think about how to ask the question. The studies that have been conducted in developing countries seem to have all generally employed WTP questions[14]. However, the reasons for this choice were not stated. It is suspected that WTP was considered easiest to elicit. Shyamsundar & Kramer (1993) chose a WTA format for their developing country study. Property rights issues and their pre-testing suggested that WTP might elicit meaningless responses. People in their study perceived traditional rights therefore asking WTP was unsuitable[15]. WTP and WTA bids were not expected to differ because they did not believe that the elasticity of substitution between the goods in question would be zero.

Once the type of question is clarified, various approaches can be used. Questions can be open-ended, closed-ended bidding or a combination of both bidding and open-ended questions. These questions can then be delivered through a survey or interview, or PRA or RRA methods can be employed. Swallow and Woudyalew (1994) used the open-ended technique in their study and found that they did not encounter problems of non-response as might be expected. While the

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[14]These studies are listed at the beginning of this section.

[15]Mitchell and Carson (1989) acknowledge that perceived rights may be more important than actual rights.

open-ended technique may generate lower responses than the closed-ended techniques, they also avoid the starting point biases associated with the closed-ended techniques. Based on their pretest of different formats, Whittington *et al* (1990) felt that the bidding game format worked best because people were most comfortable with this format. They suggested that this may be because bidding games are similar to the type of bargaining that occurs in the local markets in Haiti where they conducted their study. The dichotomous choice method was also considered appropriate by Shyamsundar & Kramer (1993). Boadu (1992) also felt that iterative bidding was suitable for his study because this approach was relevant to the way business was conducted in the local market in Ghana. Whittington et al (1990) employed the abbreviated procedure with follow-up. However, Whittington *et al* (1993) later found that the abbreviated procedure with follow-up did introduce starting point bias. If the respondent had answered yes to the offered bid in the bidding game section, they were not likely to suggest an open-ended bid above the offered bidding price. Therefore, the open-ended question did not provide any additional information. Conversely, if the respondent had answered no to the offered bid, the open-ended question elicited a wide range of answers below the offered bid. As a result any open-ended WTP bids are likely to be biased downward. With bidding games there is the question of the relevant range of values to be considered. Particularly when dealing with the possibility of starting point bias. This requires some judgement on the behalf of the researcher.

The terms of payment must also be considered so that CV estimates are relevant to the economy being considered. Generally, WTP is measured in terms of dollar value which is the accepted measure of value in developed countries. However, this may not be most appropriate in a less developed economy. Bojo (1991) suggested that for

subsistence economies it may be more appropriate to use a measure such as willingness to donate labour. If people do not have much disposable income then they may not be able to afford to pay cash. However, goods, such as maize may be a more suitable form of payment. Shyamsundar & Kramer (1993) used rice as the numeraire in their survey due to the subsistence nature of the economy they were studying. Rice is the main crop in the region therefore its value was well established. Another type of payment may be donation of building materials or other inputs. These would represent some sacrifice and therefore suggest a value.

Other reasons to consider non-monetary contribution are that some individuals may not be able to afford monetary contributions and would therefore be excluded although they might support the project. Individuals might also be reluctant to contribute money because they expect government or non-governmental organizations to finance provision of the goods (The World Bank Water Demand Research Team, 1993; Swallow & Woudyalew, 1994). This sense of entitlement to free government service may therefore influence CV responses and prevent elicitation of the "true" economic value (the World Band Water Demand Research Team, 1993).

Swallow & Woudyalew (1994) conducted a WTP survey which allowed respondents to volunteer money and/or labour. They wanted to evaluate the factors affecting individuals' tradeoffs between contributions of money or labour as well as avoiding the above two problems. They found that there was not any significant statistical relationship between the monetary and the labour contributions even though people had to make tradeoffs between the two. This was confirmed by the results of those who contributed either money or labour indicating substitution, and those contributing both money and labour indicating complementarity. In general, their results indicate that more people were willing to contribute

labour than money. They felt that this was due to the many cash demands on their limited income. However, those earning off-farm income were also reluctant which suggests a bias towards contributing money to local public goods.

Another factor related to method of payment is the payment period. In Boadu's (1992) water study, he used WTP/month because this was how water billing was conducted. However, he suggested that since the farmers do not earn monthly income then the answers may have been affected by the timing of the survey ie. WTP bids may have been higher after the harvest period. Another variation is whether payment should be in terms of regular payments over time or a one-time payment.

There has been considerable research in developed countries concerning the effect of bias on the validity of CV results. Research on bias in developing countries though has been limited to a few studies. The results, however, also seem to suggest that biases are not significant. A lack of testing for these biases in developing countries, led Whittington *et al* (1990) to approach the issue of bias in their research design. They tested for the existence and magnitude of hypothetical, strategic and starting point.

Hypothetical bias can result if the respondent does not understand or correctly perceive the goods or market being valued. Whittington *et al* (1990) felt that in the case of public projects in developing countries this should not be a problem. However in terms of information, Hsu and Li (1990) did find that new information did increase some WTP bids. Swallow & Woudyalew (1994) also found that information about the proposed project did influence bids.

Hypothetical bias can also arise if respondents do not take the CV questions seriously especially if they do not anticipate actually having to pay the amount they state.

This was considered to be quite possible in developing countries. Hsu & Li (1990) found that non-response may result if individuals do not feel that they should have to pay for the project or that the project could not be carried out effectively. While Whittington *et al* (1990) could not test whether respondents would actually pay the amount they stated, they did feel that the answers were reasonable and that the respondents did take the interview quite seriously. Therefore they did not feel that hypothetical bias was occurring. Another study by Whittington *et al* (1993) also concluded that hypothetical bias was not relevant.

While evidence from developed countries discarded strategic bias, developing country evidence from Whittington *et al* (1990) was not entirely conclusive. However, it did suggest that strategic bias was not a problem. A further study in 1993 also supported this conclusion.

Whittington *et al* (1990) also tested for starting point bias. However they did not find that bids varied systematically with different starting points. They concluded that starting point bias was not a problem. However, their study in 1993 did find that peoples' WTP bids with the open-ended question were influenced by the starting point in the bidding game section. The respondents would not raise their open-ended WTP above the closed bid suggested. However, they found that when the respondents had a clearer idea of the goods being valued starting point bias was again not a problem.

Income can also introduce bias. An estimate of total benefits may be biased downward due to an individual's severe income constraints (Swallow & Woudyalew, 1994). Bojo (1993) suggests that the relationship between WTP and wealth needs investigation. A weighting system could be developed to prevent the WTP of wealthier sectors from dominating the analysis. This income bias may actually limit the

suitability of CV because WTP may be low or even zero yet the WTP may not accurately reflect the actual value to the person.

Gender may also cause bias. If women do not have access to the household's cash resources they may be unwilling to commit a WTP bid (The World Bank Water Demand Research Team, 1993). Gender of the household head may also be a factor. It is expected that female-headed households would be likely to have less income as well as labour to contribute (Swallow & Woudyalew, 1994). Siandwazi (1989) also found evidence that female-headed households were often the poorest households and the most vulnerable to nutritional stress although they were also still often capable of meeting the family's nutritional requirements.

Another issue with administering the study is whether the respondents should be given time to think before responding. Respondents may need time to take account of their budget constraints. Such considerations may be important, particularly in subsistence households where allocation of income may be crucial. Whittington *et al* (1992) tested the effects of allowing some respondents one day before responding, while others were asked to reply immediately. They found that bids were lower when respondents were given time to think. These results are contrary to Hoehn & Randall's (1987) analysis of CV estimates of Hicksian surplus. Increased time is assumed to reduce the importance of uncertainty. Hicksian WTP measures for risk-adverse people should be less with uncertainty therefore bids should not be lower with increased time and therefore decreased uncertainty. The lower bids however may be the result of strategic bias that could occur. Respondents may discuss their bid with family members and neighbours and decide to collude to influence the actual bid. Time may also allow the respondent time to strategize individually especially if

they perceive an opportunity to "free-ride". However, Whittington *et al* (1992) did explore the issue of strategic behavior and found it unlikely that this was the cause of the lower bids. However, a later study (Whittington *et al*, 1993) did not find evidence that time to think affected bids.

Due to circumstances, there may often be a crowd present during an interview such as in a crowded area or even at the household. Whittington *et al* (1993) tested whether the presence of others during an interview influenced responses. They did not find any significant effect of people listening.

It might be expected that lack of education could also influence the usefulness of CV in developing countries. According to Hoehn & Randall (1987), frequency of incomplete responses and increased strategic behaviour would limit the usefulness of CV. While the differences between education level and demographic characteristics is substantial between people in developed countries and those in developing countries, studies in developing countries with illiterate people have been successful.

While studies in developing countries are limited, the studies that have been done all seem to suggest that CV has a definite role in measuring WTP in developing countries in addition to its well-established use in developed countries. The various studies conducted in various developing countries such as Ghana, Nigeria and Southern Haiti explored different aspects such as applicability in areas where respondents had limited education and income. They also tested various methodological issues. Positive results strongly support the use of this method in eliciting WTP in developing countries.

3.3.4 Hypothetical Variables Influencing CV Values

Several variables may influence a household's WTP value. However, these variables will vary between developed and developing countries. They may also vary between different developing countries. However, some of the variables found in other developing country CV studies will be discussed. Variables that may be relevant in this study include income, household size, education, information and perceptions. A positive relationship between income and WTP is generally expected. Several studies done on household demand for water (Whittington et al, 1987, 1991, 1993; Boadu, 1992) and a study on a National park (Abala, 1987) found household income to be significant. However, Hsu & Li (1990) found that income did not affect WTP for water. Gunatilake, Senaratne, & Abeygunawardena (1993) found that as incomes rise, the importance of foraging for non-timber forest products declines. If the importance in terms of use value declines with income then WTP may also decrease.

Related to income is employment of household members. Households with members employed off-farm may have greater cash income and be willing to pay more money. They may however be less willing to contribute labour, as found by Swallow & Woudyalew (1994). Therefore their WTP in cash terms would be affected but not their overall willingness to contribute.

Household size was suggested by Swallow & Woudyalew (1994) as another factor influencing WTP. Larger households would have greater demands on income and may be less able to contribute money, although they may be able to contribute labour. However, surprisingly, household size has been found to be insignificant in some studies (Swallow & Woudyalew, 1994; The World Bank Water Demand Research Team, 1993).

Education may also be a variable. Education plays a role in increasing outside exposure and awareness. Swallow & Woudyalew (1994) hypothesized that households with more education might be better able to process information they were given regards the resource. However, their results found education to be highly insignificant. Other studies, though, found education to be positively related to WTP (Whittington et al, 1992; Abala, 1987; The World Bank Water Demand Team, 1993).

Information and perceptions may influence WTP responses. Hsu & Li (1990) found that attitudes towards environmental protection did affect WTP for improved environmental quality. They found that perceptions and knowledge about environmental damage had a positive effect on the WTP. Swallow & Woudyalew (1994) also found that information about their proposed project influenced willingness to contribute.

Other variables are also possible. These may be cultural, social or environmental variables. However these would be more specific to the resource being valued and the specific country. Further discussion of variables, more specific to Zimbabwe, occurs in Chapter 6.

3.4 SUMMARY

In developed countries, the various valuation approaches have been applied in a number of studies. However, their application has been more limited in developing countries. Cultural and economic differences between developed and developing countries prevent valuation approaches from being transferred from developed to developing countries without careful consideration. This theoretical background forms the basis for further consideration in the following chapters.

4.0 METHODOLOGY

4.1 INTRODUCTION

Primary data was collected through field research in several villages in communal and resettlement areas. This descriptive and quantitative data was used to develop background on wildlife use and to consider valuation methods. Unstructured interviews and observations were used to provide a Rapid Rural Appraisal. Due to time constraints and unfamiliarity with a foreign culture, Rapid Rural Appraisal was seen as the most realistic approach. This approach allowed some probing into factors governing behaviour in order to determine potential causal relationships to be explored in a quantitative study.

The field research investigated several questions and issues about wildlife use. This was important in order to determine the significance of small wildlife and the factors that affect its use. The interviews included questions about collection methods, frequency and quantity of collection, and marketing of wildlife by the household. Also, attitudes and perception were considered. Some tentative attempts were made to test application of Contingent Valuation. Willingness To Pay questions were asked in order to see the manner in which people might respond. These questions were asked to determine if these might be possible in valuation studies. At a community level, enquiries were made about the political decision-making framework within the village in order to determine the applicability of a voting approach.

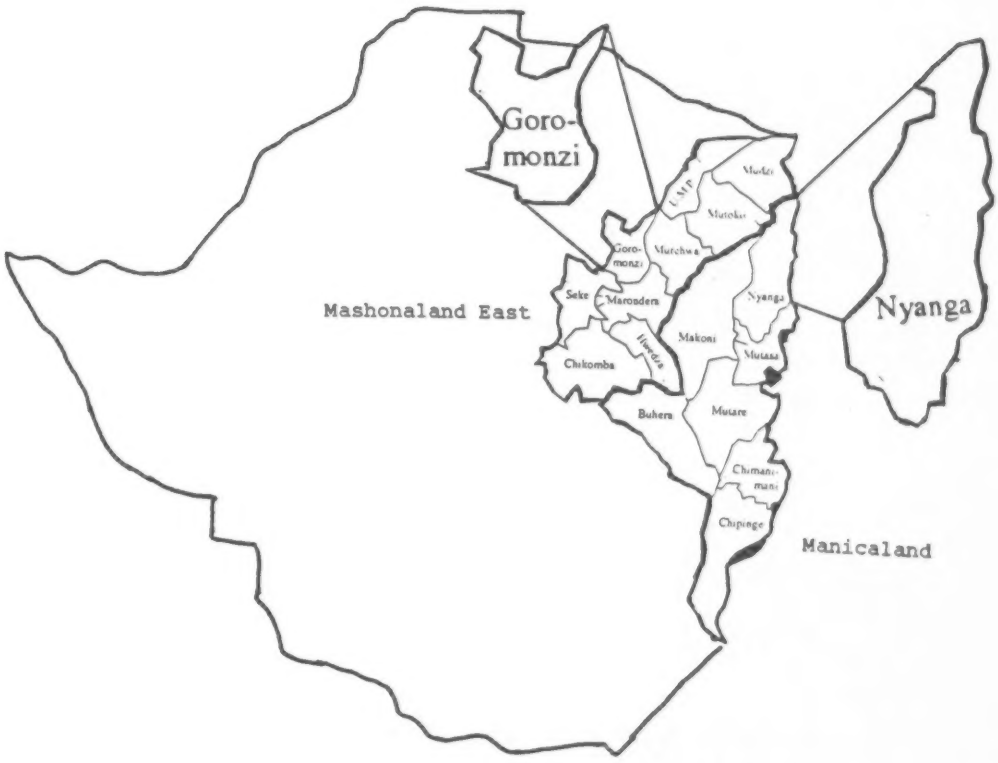
The research followed a mainly descriptive approach, although quantitative data were also collected where available from primary and secondary sources. Quantitative

data can be analyzed with various statistical techniques to provide the researcher with evidence to support hypotheses or to derive amounts and values. However, descriptive data also have merit and their value is not just restricted to cases where quantitative data is unavailable (da Corta & Venkateshwarlu, 1993). Quantitative data alone may not be sufficient to capture changes. Descriptive data however can be used to capture the dynamic social and economic processes. Therefore, descriptive data may be necessary for interpretation of quantitative data (Tefft *et al*, 1990).

Due to the variation across households, descriptive data can sometimes provide a better picture of how households make resource allocation decisions. This explanatory data provides a more complete picture which is important, particularly when researching issues which have had little previous research. In these instances, a descriptive model must be constructed before quantitative analysis is effective. Forming a descriptive model is the rationale behind this study. The study does not claim statistical accuracy in its quantitative data. It only aims to use the quantitative data to be indicative. This quantitative data combined with descriptive data is used to build a descriptive model as a basis for future statistical studies.

4.2 STUDY AREAS

The two field studies included several villages located throughout the two main research areas. The initial main research was conducted in Chinamura area within Goromonzi district with the second study located in Nyanga district (Map 4.1). In addition, other communities were also visited where some interviews were conducted. However these visits constituted more of a rural tourism approach with opportunistic interviews.



MAP 4.1 Study Areas

The purpose of selecting two main sites involving several villages was to broaden the focus. Two sites also allowed some scope for comparative work. Because no site is typical or representative it was felt that visiting different areas would contextualize the fieldwork and help to develop an understanding, however superficial, of processes in different areas. While the second study served to broaden the focus of the research, it also gave a fresh perspective on the economic and social processes. Also, since the second study was conducted some time after the first study it allowed some aspects to be covered that were uncovered during the first study and subsequent literature review. Some opportunistic interviews also occurred in the Wedza and Mutoko districts and supplemented the main research.

4.2.1 Chinamura Study Area

The first study was based in the Chinamura Tribal Trust Land, located about 30 km northeast of Harare, near Domboshawa town. This communal area is within the Goromonzi district in the province Mashonaland East. The Chinamura area was selected due to its close proximity to Harare which enabled easy access for this initial field study. This site also satisfied the desire for a site located near a city or major business centre in order to consider the influence of markets on uses and values of the small wildlife resources.

A total of six villages were visited in three of Chinamura's five wards. These included Chipatiko, Tagarira and Murape in Murape ward; Chidarikire and Bapatu in Mawanga ward; and Munyawira in Munyawira ward. Interviews were conducted during day field visits carried out intermittently over a week period in each area. A total of 38 households were interviewed.

Goromonzi district, covering an area of 2 519 km^2 has a total population of 147 126 persons, comprised of 32 047

households at a density of 59 person/km^2 (CSO, 1992). The average household size for the district was 4.6 persons. The populations for Murape, Mawanga and Munywira, the three wards studied within the district, were 2 249, 9 308 and 7 103 persons respectively with household sizes of 5.0, 5.3 and 5.1 persons.

At an elevation of 1 550 m, this area is located in the Northern Highveld (Anderson *et al*, 1993). The climax vegetation of *Brachystegia spp.*, is located on well drained upland sites on granitic terrain. While savanna woodland forms the most important vegetation type in this area there is also vlei grassland. The area is characterized by granitic rock outcrops of the bornhardt and castle kopje types separated by gently sloping pediment slopes with few to common vleis.

The three wards are located within natural region IIa. While rainfall occurs only in the summer, it is reliable and moderately high at 880 mm annually. This makes the area suitable for intensive farming of rainfed crops, such as maize, tobacco and cotton as well as for beef production. However, classified as land capability class III it is subject to severe limitations and risk of damage and there has been some evidence of slight to moderate sheet erosion. Therefore it is suitable for cropping only with the application of intensive protective measures and/or special practices.

Soils are well drained with moderately shallow to deep coarse-grained sands to sandy loams over yellowish-red coarse-grained sandy clay loams. The soil in this area is low in nutrients. Murape and Mawange wards have loamy soil which is very poor. In Munywira, soil is sandy loam which is slightly better. The soil is best suited for flue-cured tobacco because nutrient content of the soil can be easily

controlled. However, the main crop grown by the communal area farmers is maize. In 1987/88 the area was 19% cultivated with 90% of cultivation in maize. Other crops grown include groundnuts, sunflower, tomatoes, English giant rape, cabbage, onions, pumpkins, carrots, sugarloaf, peas and beans. In Murape, fewer vegetables are grown because many people work in Harare and are less agriculturally inclined (Agritex officer, pers. comm.). In Munywira some cotton is grown and some people (less than 1%) grow burley tobacco in pockets of red soil.

The village arrangements in these areas varies. Near the main road and business centres, villages are arranged with households lining both sides of lanes perpendicular to the main road such as in Murape ward. However, farther away from the main highway, as in Mawanga and Munywira wards, the villages become more spread out and less ordered. Average land holdings in the study area are about 0.32 ha/person or about 1.5 ha/household.

4.2.2 Nyanga Study Area

The second research area was located in Nyanga district. Nyanga district lies in the Eastern Highlands, east of Harare, in Manicaland province. The total population of Nyanga is 128 467 persons in an area of 5 897 km^2 resulting in a population density of 22 persons/km^2 (CSO, 1992).

With the assistance of the District Administrator, two wards were selected out of the thirty seven wards and a third was added later. Five villages in the three wards were visited. These included Nyahumbe, Nhyari and Gukutu, three resettlement villages in Ward 27-Sanyatwe; Nhonhegapundi village in the communal area of Ward 22-Gonde; and Nyhokwe, a resettlement village located in Ward 36-Ruchera. Eighteen interviews were conducted in these villages over a period of three days.

Gonde ward is located in the south of Nyanga district. It has a total population of 4 104 and 1 033 households with an average household size of 4.0 persons. Gonde is located adjacent to Nyanga town. Villages are quite structured with households lining the main road off the highway. It is located within natural region IIb which is an intensive farming region suitable for rainfed crops. The soil is sandy. This area receives 850 - 1 000 mm rainfall although some dry spells during the rainy season or a shorter rainy season may occur, affecting crop yields in some years. Crops grown in the area include maize, groundnuts, beans and sunflowers.

Sanyatwe resettlement area was established in 1980. It has a population of 1 977 within 381 households of an average size of 5.2 persons. Villages ranged from households lining the main road to more remote villages with difficult vehicle access. Sanyatwe is in natural region I, which is a high potential area suitable for specialized crops such as coffee, fruits, maize, etc. This area has high rainfall, greater than 1000 mm and normally receives some precipitation throughout the year. Soil is deep. Crops grown in this area include maize, sunflower and some potatoes. While fruit production is more suitable than field crops these are only grown on commercial farms.

Ruchera resettlement area was resettled in 1983. This resettlement contains 2 345 people, and 419 households of 5.6 persons each. This ward was relatively far from the main highway. Households were located fairly far apart and appeared to have quite large holdings surrounding them. This area is also located in natural region IIb and is therefore suitable for rainfed crops although some dry spells and shorter rainy periods may occur.

4.3 SAMPLING

Various villages were purposively selected within the two areas in order to represent a variety of physical and socio-economic environments. Varying access to resources as well as population densities, wealth and access to markets were considered to be factors that might influence wildlife use and values. The household was selected as the basic sampling unit therefore this survey can be considered a household survey. The questions on wildlife uses were in terms of the entire household. However with respect to questions on perspectives and WTP, the answer was specific to the individual interviewed and did not necessarily represent the views of the entire household.

The household is the most appropriate sampling unit because in rural areas in developing countries the household is the most common unit of production and consumption (Devereux & Hoddinott, 1993; Casley & Lury, 1987). The majority of the population in these areas depend on agriculture and consume or sell agricultural commodities that they have produced as an operating unit. Other products may also be collected or produced by the household for consumption or sale. However, increasing urbanization and the occurrence of household members working and living elsewhere in order to substantiate household income has caused the household unit to lose its coherence and become more difficult to define.

While there is some discrepancy in defining the household unit certain common factors are apparent throughout most definitions. During the interview the household members were asked to indicate their household members. The following definition was derived based on how the respondents classified their households, field observation, as well as drawing from other definitions (Devereux & Hoddinott, 1993; Campbell *et al*, 1989; Casley & Lury, 1987).

The household is defined as including those members, usually bound by ties of kinship who live together on the same homestead, share a common food source and are answerable to the same household head. However, it is recognized that within the holding there may be several distinct households, which are related by kin but which function individually. This definition includes absent household heads who may be working and resident elsewhere but contribute income to the household which is considered their permanent place of residence. Also, workers may be included if living and working with the family. However, this classification does not include other family members who permanently live elsewhere even if they do contribute remittances to the household.

The purposive selection of households to interview within the sample villages was intended to include as many different socio-economic and physical conditions as possible. Within each village area, scattered households were selected which portrayed varying apparent levels of wealth based on superficial and obvious assets, were located in different proximities to business centres or were remote, and which were located in different environments. These factors were considered so that linkages between these factors and wildlife utilization and value could be considered.

Choice of households was also influenced by the presence of household members. Generally, any of the adult household members who were present were invited to respond, although input from children was also accepted. Also, in some cases multiple households were interviewed concurrently. This occurred in instances where a few villagers were gathered together or if a visitor arrived near the start of the interview. While this allowed multiple interviews in one sitting, it resulted in a long interview period for those

involved because they had to wait for the responses of the others. The multiple interviews conducted at one household also did not allow for observation of the holdings of the visiting respondents.

For the purpose of this study, a holding will be narrowly defined as the living structures, other buildings and structures such as animal pens and enclosures, possessions in the yard such as vehicles or trailers, and the land surrounding the household or located nearby that is the property of the household. This does not include communal land. Very limited information was gathered with respect to holdings. This information was gained through observations by the researcher and did not involve questioning the respondent. This information was only intended to serve as a rough indicator of wealth.

Accurate information on wealth and income is difficult and time-consuming to obtain therefore indirect measures were used. Whittington *et al* (1990a) and Campbell *et al* (1989) also used this approach. The observations used in this study included the number of buildings and descriptions about their construction such as shape and size (round or rectangle, one or multiple rooms), building materials (brick, block, concrete, mud, stick), roofing material (asbestos, tin, thatch), concrete foundations and any extra features such as windows with glass, stone work or paint.

Observations also included other structures in the yard such as the presence of toilet structures, animal pens and storage buildings, and their construction and building materials (stick, wire, concrete). Vehicles, trailers and other possessions such as furniture and radios were also used as indicators of wealth. However, these observations only included what was apparent to the interviewer during the interview and there was no exploration or stock taking involved.

4.4 INTERVIEW DESIGN

The collection of quantitative and descriptive data consisted of unstructured interviews[1]. Subsequent to the interviews, further quantitative and descriptive data was also derived through observation of the physical and socio-economic environment. The intent of these interviews and observations was to give insight into actions, behavior and motivation that may influence wildlife utilization. The idea of doing a site-specific case study was rejected in favor of a broader 'cases' study. This latter approach was considered more valuable to the researcher's interests.

In-depth structured interviews were not considered as these would be difficult to do successfully due to time limitations and unfamiliarity with the culture. Another approach involves recording data from a distance without participating in the action. This approach would have been useful to supplement the interviews, however was not feasible due to lack of time.

Participatory Rural Appraisal (PRA) was another method which was not employed. PRA involves communication with a community through various appropriate mediums to establish information about the community[2]. Swallow & Woudyalew (1994) suggest that CV can be useful when incorporated into a PRA approach. Campbell *et al* (1994) have employed PRA in Zimbabwe and conducted a workshop on the success of PRA techniques. They felt that PRA was useful in providing a descriptive framework and resource inventory that set the stage for the valuation work. PRA could also be used to define key issues which could then be tackled with

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[1]For reference to unstructured interview techniques see Devereux & Hoddinott (1993) or Whyte (1977).

[2]The term PRA actually refers to empowering people by getting their input and feedback therefore when this method is used just to extract information it should not be termed PRA.

conventional data collection and economic techniques. They suggested that PRA had potential to be used to collect economic data. PRA exercises, such as ranking, may even offer alternative ways of exploring non-market values. While this technique has considerable merit, it is more useful in trying to gain a community level perspective but does not give a very detailed household level perspective. However because this study focuses on household use and values, select household interviews were seen as the most suitable way of identifying the relevant variables and analytical tools.

The unstructured approach was considered most appropriate, particularly as the purpose of the interview was not just to collect detailed quantitative data on the amounts of wildlife collected but to obtain descriptive data on the actual uses and methods of collection of wildlife as well as social factors influencing wildlife use and values. The unstructured approach is useful in revealing background information and can be used to build a descriptive profile of a household. While unstructured interviews may be marked by their unrepresentativeness, the purpose of the study was not to determine statistical aggregates (Devereux & Hoddinott, 1993).

A variety of respondents was consulted to obtain a cross-section of household observations. With the unstructured approach, all respondents are not considered equal (Whyte, 1977). Therefore, the choice of interview questions can be altered depending on how informed the respondent is and the relevance of certain questions to their situation. It was also felt that by following an unstructured approach the interview would be less formal and more informative. This approach was also seen as less intimidating while still providing the desired information.

A semi-formal approach is used with unstructured interviews. While a formal questionnaire is not used, nevertheless a design is followed. This requires familiarity with the topic of the interview and a standard set of key questions are prepared in advance which are consulted throughout the interviews. The questions are ordered to allow a logical flow to the interview and this order may vary between different households.

The interviews were conducted with the aid of a research assistant who translated the questions into Shona, the language of the study area. The flow of the interview was led by the researcher with suggestions from the assistant. The researcher determined the questions and ordering of these questions to derive the information being sought. In some cases this involved different approaches to the same question. Some questions started more general and then became more specific in order to elicit greater detail, particularly with regards to frequencies and quantities. Also, small time frames such as weekly or monthly amounts were used because these were more realistic when trying to get household amounts.

Interviewing within the village first required locating the village head to obtain permission to conduct interviews in the village. The village head then became the first household to be interviewed. Interviews initially began with an introduction of the researcher and assistant as well as an explanation of the purpose of the interview. After permission to conduct the interview was received, selection of the interview location was determined by the respondent. If the respondents were working then the interview was conducted where convenient such as in the field or inside the cooking hut in order not to interrupt their activity.

Interviews consisted of a set of questions which followed a general design. Initial questions involved listing the

various small wildlife resources used. However this wildlife was not specifically identified but was listed generally ie. mice, birds, locusts. This list was then used to gather information for the various wildlife on the collection methods, frequency and quantity of collection, marketing of these resources and any additional notes. The purpose of this line of questioning was to gain some perspective of the significance of the small wildlife use in their lives through the quantity used and the time involved in collection. The quantity and cost of meat consumption was also determined in order to look at substitution.

Further questioning also involved peoples' perceptions of the importance of small wildlife to their household, the status of the small wildlife populations, and if they would like small wildlife populations to increase. If wildlife was considered important by the respondent then further WTP questions were asked to see if they were able to indicate any type of value. A general project to increase wildlife in the area was suggested and the respondent was asked what they would be WTP towards a project. These WTP questions were open-ended, however, the purpose was just to try WTP questions but they were not conducted in a rigorous manner to test them. The WTP questions were only conducted to get an idea of the respondent's ability to respond and perhaps gain some insight as to why they may not be able to respond.

Questions on political processes in the village were also asked in the second field study to understand how decisions are reached and who has the power. This is necessary when considering the relevance of the referendum CV approach. In some cases, respondents were consulted about social and religious laws and customs which affected wildlife use. Finally, the household composition was determined.

Throughout the interview the researcher also collected some data on the quantity and quality of the holdings based on

visual observation. However this stock-taking was not included in the questioning. These observations were to allow some general determination of wealth.

Before concluding the interview, the household members were allowed to ask the researcher any questions they had or to offer any comments. At the conclusion, the respondent was thanked and presented with a package of seeds as a token of appreciation for their time. This was met with a positive response.

While there is always the risk that answers are not given truthfully or accurately, it was generally felt that most respondents were as accurate as possible. Wilson (1990) notes that in Shona society a lie or exaggeration is often seen as more interesting than the truth. However, lying is not considered shameful and will be simply laughed off or ignored if discovered. Children were not interviewed, unless in the presence of adults. It had been suggested by the research assistant that children might not answer truthfully. It is realized that some of the respondents' answers may have been based on what they felt the interviewer wanted to hear. However, there did not appear to be any reason for this strategic behaviour to occur. In fact, several respondents answered negatively to questions where it can be assumed that a positive answer would be preferred. Also, there is also the possibility that the respondent may not have fully understood the question or the assistant may not have correctly relayed the information back to the researcher. This non-sampling error may be present to some degree. However, some cross-checking was possible through comparison with the other interview results within the same area.

In summary, the research on households in the two areas, Chinamura and Nyanga, posited information on the use of small wildlife, factors affecting this use, as well as

factors that may affect the success of valuation approaches and in particular WTP questions. These data can be used to represent the importance of small wildlife. Also, this information provides the background for valuation in the communal area setting.

5.0 RESULTS OF FIELD RESEARCH

5.1 INTRODUCTION

The purpose of the field research was to get some perspective on the importance of small wildlife to the households. Two field studies were conducted. The main study in Chinamura was used to explore several areas of wildlife use. A smaller study in Nyanga followed the same format however with a smaller sample. The main purpose of this second study was for comparison with the main study area. This smaller study could render results that dispell potential generalizations that may arise from the main study and be applied to Zimbabwe as a whole. Other opportunistic interviews in other rural areas also contributed to developing the background.

Documentation of which wildlife is used, frequency and quantity of use, collection methods and season of collection, uses of the wildlife and marketing aspects provides some picture of the role of this wildlife in household lives. Factors that may influence use were considered including household characteristics of wealth[1], remoteness of location[2] and the reasons people stated for not to consuming certain wildlife. Also, people's attitudes towards wildlife and their WTP were explored. The results of the studies provide some useful insight into wildlife use through descriptive and quantitative observations.

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[1]Households were grouped into higher, middle and lower wealth groupings according to observations about their holdings.

[2]Households were classified according to their access to main roads and stores.

5.2 CHINAMURA STUDY AREA

5.2.1 Area Description

A total of 38 households were interviewed in six villages located throughout Chinamura communal area. The field data are documented in Table D.1, Appendix D. Five households were interviewed in Chipatiko village, five in Tagarira village and five in Murape village in Murape ward. In Mawanga ward, one household was interviewed in Chadarikire village and four in Bapatu village. The remaining eighteen households were interviewed in Munyawira village in Munyawira ward. These villages encompassed different levels of village organization, wealth, remoteness and a variety of other socio-economic characteristics.

The first village, Chipatiko, was located between the Murape business centre[3] and the larger Showground business centre. This village was down a side road off the main highway from Harare and was classified in the least remote grouping. Homesteads were close to each other. Most households lived in round huts of brick and thatch and were in the lower and middle wealth groupings. There were few trees in the area other than the few trees on the holdings.

Tagarira village, in contrast, was a wealthier village with most households in the higher wealth grouping. All households had houses and some households had more than one house. These houses were painted with framed doors and windows. Yards were large and enclosed by chain link fences with iron gates. The village was very structured with side roads running perpendicular to the highway. Homesteads were arranged side by side lining the side road. Large homesteads were also located facing the highway. Tagarira

[3]A business centre is a grouping of small shops and businesses.

village was located close to the Murape business centre and therefore fell into the least remote grouping.

Chidarakire village was located on the main road that branched off the highway. However, it was classified as average remoteness because it was quite distant from the highway and larger business centres, although relatively close to a small business centre. Only one household was interviewed. This household was in the higher wealth grouping and had several houses. Other households in the area also had houses although some had huts.

Bapatu village was of average remoteness. It was located far down a side road off the main road, however still close to a nearby small business centre. This village was not very structured. Homesteads were located far apart and randomly distributed. Households were from a range of wealth groupings.

Murape village was located on a side road across from Murape business centre and therefore in the least remote grouping. This village was quite built up and homesteads were lined up residentially along the side road. There were not many trees in the area other than some trees and bushes lining the road. Houses were generally fairly large with a couple rooms. Several people in this village commute to Harare. Several people from Murape live in Harare fulltime, but have an unoccupied homestead in Murape which they can return to if necessary or when they retire. This situation did not seem to occur in any of the other villages.

Munyawira village covered a large area and therefore included all wealth and remoteness groupings. Households 23 and 26 were classified as most remote. They were located off a main road, down a narrow lane that was not suitable for vehicles. Households 21, 24 and 25 were on a main road with household 21 facing Munyawira business centre,

therefore making them least remote. Households 27-30 were in the most remote category. This cluster was located down a side road and off a main road and hard to access due to the condition of the lane. There were a variety of wealth groupings in this cluster. The cluster of households 31-38 were also categorized as most remote. The lane they were located along was quite distant from Munywira business centre and in poor condition. This village appears to have been established longer than most households interviewed in the area because of the style of some of the huts[4]. These huts were thatched and rectangular rather than round. This cluster also had a variety of wealth groupings.

5.2.2 Small Wildlife Utilization

The main wildlife used (listed in terms of decreasing use) included species of mice, birds, hares, wild pig and buck[5] as well as insects such as ishwa, locusts, tsambarafuta, madora, mandere and makurwe[6] (Table 5.1). There was a large variation between households in the quantities and species of wildlife collected. The species utilized in this study are incorporated in Table C.2, Appendix C.

Mice and birds were the most commonly collected animals. These mice and birds were collected by 19 and 21 of the 38 households (50% and 55%) respectively. However, mice were collected in greater numbers and frequency. Birds were generally hunted 1-2 times/week with a success rate of 1-6 birds/trip. However some people reported only occasional success, such as 1 bird/month or year, which occurred as a result of circumstance. Because most hunting is done by

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[4]This observation was made by my research assistant.

[5]It is suspected that the term buck refers to the duiker, although it could possibly include the other small ungulate species.

[6]A mixture of common and indigeneous names were used because in some cases the indigeneous name was more specific. The common, scientific and indigeneous names are found in Table C.2, Appendix C.

TABLE 5.1 Number of Households Utilizing Small Wildlife

Wildlife[7]	Number of Households
Birds	21
Mice	19
Hare	9
Buck	5
Wild Pig	2
Ishwa	21
Locust	16
Tsambarafuta	16
Madora	15
Mandere	5
Mukurwe	3

[7]Some wildlife (mice, ishwa, madora. locusts) was purchased as well as collected.

young boys this hunting is generally done on weekends while herding and more frequently during school holidays.

Depending on the method of collection, quantities of mice collected per day ranged from only a few to a hundred. Ten of the seventeen households that collected only collected during harvest period. Frequency of collection may range from 3-4 times/week to every day and may be for one week or over an eight week period. This collection, while harvesting, by digging or hitting the mice, often amounts in 1-6 mice/day although some reported 20-40 mice/day. However, trapping is practiced by others for 3-6 months of the year. Trapping may result in 10-20 mice/day. Some people, though, reported 30-60 mice/day and one person reported 100/day. Trapping is usually done 1-2 times/week although some people trap more often.

Hares were collected occasionally while buck and wild pig were very rare. While nine households reported catching hares, they were not collected in large amounts. Hunting trips were undertaken by some people from 1-5 times/month with 1-2 hares/trip. Others did not make a special trip but occasionally came across a hare. However, this was rare and only amounted to about 1 hare/year. Buck were only reported by five households and these all stated that it was a matter of circumstance and very rare. Only two people hunted wild pigs. The wild pigs were hunted during the rainy season by chance encounter. However during the setting of the crops a person might take a trip for four or five days resulting in two pigs.

Insect consumption was quite common, particularly ishwa which was collected in fairly large amounts by 21 households. However, this collection was highly seasonal and only occurred over a two month period during the rainy season. The amount and number of trips per week was highly dependent on the rains. During this time 1-3 buckets/day

might be collected about 2-3 times/week. One women reported 20 L/day however the frequency of her collection varied from none in a week to several consecutive days. Ten households who did not collect ishwa did however buy it from others. Therefore, at least 83% of the households were consuming ishwa.

Tsambarafuta were also collected in small numbers by 14 households (37%). However, tsambarafuta are only available for the first three weeks of rainfall and usually very few are collected. Some households collected 1-3 cups/season. However, one household filled a large basin/trip and another household collected a 2 kg bag/trip with about 3 trips/week.

Locusts were listed by 15 households (39%). These are also very seasonal in collection, although collected in much smaller numbers than the ishwa. Amounts collected during harvest were stated as very few. Most people claimed 1-4 locusts/day while some collected a handful or small basinful which would probably amount to around 10 or 12 locusts.

Madora, mandere and makurwe were collected by fewer households. Madora was only collected by two households. However, 13 households buy madora from the store. This madora came from elsewhere[8]. It is suspected that madora are very rare in this area or else they would be collected by more households because these households collect other wildlife. Five households collected mandere for about a one month period at the beginning of the rainy season. Generally, this amounted to a small dishful collected once a week to every day. Makurwe were collected by only three households. One household only collected them occasionally, another made one trip each weekend and collected a large

[8]There is a company located in Bulawayo which processes and packages madora. The madora is probably gathered in that area.

cupful, while the third household collected about 60/weekend while herding.

Households were roughly grouped into wealth groupings in order to obtain some indication of the distribution of use among the different users (Table 5.2). Households were distributed with 15 households in the higher wealth group, 8 in the middle wealth group, 11 in the lower wealth group and 4 households that could not be placed because their holdings were not viewed.

Contrary to expectations and literature findings, a higher proportion of the higher wealth households utilized wildlife compared to the middle and lower wealth households (Table 5.3). The higher wealth households also utilized a greater variety of wildlife.

Households were classified according to the remoteness of their location[9] (Table 5.4). However this distribution is not an indication of overall distribution of households in the area but is the result of purposive sampling. There were 19 households in the least remote group which were located near stores and a main road. The middle group which were located farther away from stores had 4 households. The most remote group contained 15 households which were located far from stores and did not have good road access.

Wealth groupings were compared to remoteness of the household (Table 5.5). The highest proportion of the higher wealth households were in the least remote areas compared to a higher proportion of lower wealth households in the more remote area. However, this may be an artifact of the sampling.

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[9]The households were arbitrarily classified on a scale of 1-3 according to their access to main roads and particularily stores. Households classified as 1 or least remote are located near the main road and stores. A classification of 2 indicates that the household is more distant from stores but does have fairly easy access. Households that are located quite distant from stores and do not have easy road access are classified as 3.

TABLE 5.2 **Wealth Groupings of Study Households in Chinamura.**

Wealth Grouping	Lower Wealth Group	Middle Wealth Group	Higher Wealth Group	No Grouping[10]	Total Nr. of Hshlds
Number of Households	12	7	15	4	38

TABLE 5.3 **Number of Households Utilizing Wildlife According To Wealth Grouping.**

Wildlife	Lower Wealth Grouping	Middle Wealth Grouping	Higher Wealth Grouping	No Grouping	Total Nr. of Hshlds
Birds	5	3	9	4	21
Mice	4	4	9	2	19
Hare	2	1	5	1	9
Buck	0	1	3	1	5
Wild Pig	1	0	0	1	2
Ishwa	10	4	13	4	31
Locust	4	3	7	2	16
Tsambarafuta	4	2	7	3	16
Madora[11]	0/4	0/0	2/7	2/1	4/11
Mandere	1	0	3	1	5
Makurwe	1	0	2	0	3

[10]These households were not grouped because the interviews were conducted away from the homesite. Therefore there were no observations of holdings to base the grouping on.

[11]While several people consumed madora, this madora was generally purchaed from the store and was not from the area. The first number in each column represents the number of households that collect while the second number is the number of households that purchases.

TABLE 5.4 Classification of Households According to Remoteness.

Remoteness Category	1 Least Remote	2 Average	3 Most Remote	Total Nr. of Hshlds
Number of Hshlds	19	4	15	38

TABLE 5.5 Number of Hshlds In Each Remoteness Category Based on Wealth Groupings.

Remoteness Category	1 Least Remote	2 Average	3 Most Remote	Total Nr. of Hshlds
Lower Wealth Grouping	5	1	6	12
Middle Wealth Grouping	2	1	4	7
Higher Wealth Grouping	9	1	5	15
Uncertain	3	1	0	4
Total Nr. of Hshlds.	19	4	15	38

TABLE 5.6 **Number of Households In Each Remoteness Category Utilizing Particular Wildlife.**

Wildlife	1 Least Remote	2 Average	3 Most Remote	Total Nr. of Hshlds
Birds	10	2	9	21
Mice	9	2	8	19
Hare	6	0	3	9
Buck	4	0	1	5
Wild Pig	1	0	1	2
Ishwa	14	5	12	31
Locust	6	0	10	16
Tsambarafuta	7	3	6	16
Madora[12]	3/6	0/1	1/4	15
Mandere	3	0	2	5
Makurwe	0	0	3	3

[12]The first number in each column is the number of households that collect madora while the second number is the number of households that purchase madora.

Small wildlife utilization did not seem to be affected by remoteness. The proportion of use between the least and most remote areas was similar (Table 5.6). One household though did mention that they collect a lot of mice because they are far from the stores.

5.2.3 Collection of Small Wildlife

Methods of collection required mimimal and very simple equipment. The trapping techniques usually utilized materials from the environment and therefore very little expenditure was required. Time was also generally not a significant factor because much of the collection was done concurrently with other tasks such as harvesting or herding cattle. However, certain species, such as ishwa, tsambarafuta and mandere, did warrant time allocation because their occurrence was seasonal and influenced by weather. Generally, though the source of these insects was near the household and collection only required about an hour. Some households though did undertake hunting trips for birds, hares, buck or wild pigs but this was not very common. However, several households did trap mice which involved setting and checking the traps regularly.

Birds are generally collected opportunistically by young boys and do not involve a specific trip. The birds are usually hunted with a simple catapult by young boys while herding the cattle. One man also reported that he caught birds regularly according to circumstance and in fact he was carrying a catapult while out walking. In one household the females collected young birds from the nests while they were out collecting fuelwood. Some boys also go out trapping birds using a sticky fluid extracted from a local tree. This trapping may be done while herding or as a specific trip.

Mice collection during harvesting was done by all members of the household. The mice are caught by hitting them with maize stalks as the mice run out of the stalk piles. The mice are also dug up if a person sees a hole in the ground. Outside the harvest season however, collection by digging and trapping is done by the men and particularly young boys. Two methods of trapping are used. One method is to prop a stone up with a stick. A string is tied to the stick and a piece of corn is tied to the middle of the string. Therefore when the mouse takes the corn, the stone collapses on top of the mouse. With the second method a bucket is inserted into the ground. The bucket is filled with water and the rim is smeared with peanut butter. The mouse falls in and drowns when attracted by the peanut butter. Several traps can be set at a time. One household reported 40-50 traps while another had 60 traps. Setting up the traps is time consuming and may take about an hour. However, checking the traps does not take long. Generally larger amounts of mice were collected by trapping than by digging.

Hares are hunted by male household heads using dogs and a club. A specific trip is made which may take the whole day. These trips however were not found to be very common and they only resulted in one or two hares.

Hunting trips for buck and wild pig were even less common. Buck were usually caught as a matter of circumstance such as while out hunting for hares. One household, though, did go on hunting trips when wild pigs were sighted. The wild pigs were pursued with a spear and dogs and the trip might involve four or five days. During the trip, food was not carried but the hunter would get food for himself and his dogs from farmers along the way.

Ishwa are collected from the termite mounds around the homestead and in the grazing areas. These can be collected by anyone but generally by the women and children. Their

occurrence is only during a short period from November to December. During this period they emerge in great numbers immediately after a rainfall. Therefore other jobs are abandoned as soon as the ishwa are sighted emerging from the mound. A bucket trap is created by setting a bucket into the termite mound so that the ishwa enter it. Some people may use their hands to collect the ishwa as they emerge.

Tsambarafuta are also only collected during the rainy months of November and December. These are collected by women, and in particular children, who consider it a game to catch them to eat as treats. If the tsambarafuta are active then the women and children may go collect them for about an hour.

Mandere, another rainy season insect, are found on the msasa trees while they have leaves. The mandere are collected by children while herding. The children shake the trees so that the mandere fall out. Madora are also collected by children while herding in November and December. Young boys may make a special trip for a morning on the weekend to collect Makurwe.

Locusts are usually collected opportunistically while harvesting. They are caught by hand when sighted in the field. They also may be caught during the morning dew before they take off.

Generally most insects and small wildlife were very seasonal and seemed to coincide with the occurrence of the rainy season or the harvest. This however seemed to present little conflict with agricultural activities, especially because most collection was opportunistic. If there was conflict between wildlife collection and agricultural activities, agricultural activities usually took precedence. A timeline of agricultural activities and wildlife seasons is included in Table D.4, Appendix D.

5.2.4 Use of Small Wildlife

Most of the wildlife collected was for household consumption only, although marketing of surplus also did occur. The wildlife was not generally used as a main source of food. However, if collected in large enough quantities it could provide an alternative relish which may be substituted for meat or used in addition. In particular, mice may be used for relish or preserved if they are collected in bulk. Ishwa often serves as a relish. One household stated that ishwa is very important because it saves a lot of money as well as providing a change in the diet. Another household said that ishwa was good for the diet while providing no hazard to crops. Some wildlife serves as a snack or a treat. Insects, such as tsambarafuta are a child's treat. Mice are eaten as a snack by men in the beer halls. Much of the wildlife collection is by children while herding or doing other tasks and is probably eaten at the time. These snacks, however, may be important supplements to the child's diet.

5.2.5 Marketing of Small Wildlife

There appears to be well-established markets for certain wildlife products. Marketing of wildlife resources was practiced by several households (Table 5.7). The most common resources marketed included mice, ishwa, and madora with smaller amounts of birds, hares and locusts. Markets may be formal such as with madora which comes from Bulawayo and is dried, packaged and sold in local shops. However, there is a lot of informal marketing among neighbours or at beer halls. In one household, the young boys take orders for birds and then trap them live to meet their orders. Six households sell wildlife, fourteen households purchase wildlife and seven households both purchase and sell different wildlife.

TABLE 5.7 Number of Households Involved In Marketing Wildlife Products.

Wildlife	Nr. of Hshlds That Sell Wildlife	Nr. of Hshlds That Purchase Wildlife
Birds	1	0
Mice	4	3
Hare	0	1
Ishwa	10	10
Locust	0	1
Madora	0	13

TABLE 5.8 Marketing of Wildlife Products By Households According To Wealth Groupings.

Wildlife	Lower Wealth Grouping		Middle Wealth Grouping		Higher Wealth Grouping		No Grouping		Total Nr. of Hshlds	
	buy	sell	buy	sell	buy	sell	buy	sell	buy	sell
Birds	0	0	0	0	0	1	0	0	0	1
Mice	1	1	0	1	2	0	0	2	3	4
Hare	0	0	1	0	0	0	0	0	1	0
Ishwa	3	6	2	1	5	2	0	1	10	10
Locust	0	0	0	0	0	0	1	0	1	0
Madora	5	0	0	0	6	0	2	0	13	0
Total Nr. of Hshlds In Wildlife Market[13]	4 (2)	4	3	1	7 (3)	0	1 (2)	0	15 (7)	5

[13]This row is not a summation of the table because some households sell or buy multiple items. The number in brackets indicates households that buy and sell.

Purchasing and selling of wildlife occurred in households in all wealth groupings (Table 5.8). Several households in the higher wealth grouping bought wildlife with a few households also selling wildlife. However, in the lower wealth grouping a smaller proportion of households bought wildlife while a higher proportion sold wildlife compared to the higher wealth households.

The most selling and purchasing of wildlife occurred in the least remote areas (Table 5.9). However, several households in the most remote areas did purchase wildlife although very few sold wildlife. One household purchased mice regularly because they are located near the stores. Another household mentioned that they did not purchase madora often because they are far from the stores.

Some prices for basic goods stocked in the local stores are included in Table D.2, Appendix D. These prices may be used to put the prices of marketed wildlife in perspective. Some households stated that the income from wildlife was important in helping to pay for purchased goods. These prices also give an indication of some household expenses.

Mice were sold by four households. The mice ranged in price from $0.15 - $1.00 each depending on whether they were processed (cooked) or not. Generally they tended to be under $0.50 each. These were often sold at beer halls. Households reported selling 20-30/weekend. Three households purchased mice in small quantities a couple times a week from people who came around selling them. One household did not purchase mice because some people may sell rats.

Ishwa is only available for a short period each year, however during that period there is considerable marketing. Ten households sold ishwa and ten households purchased ishwa. Ishwa sold for $1.00/small cup and $2.00/large cup. Households often sold 5-6 cups per day from home, although

one household reported earning $30-40/day. Ishwa may be sold from home every day if the ishwa is available. However, some households made market trips two to three times per week where they could sell over 10 cups/day. One household sold their ishwa at the market in Harare (the capital city) when they went to sell their vegetables. They sold about 10 cups/day for $1/cup. As well as selling ishwa they had collected themselves, this household also bought ishwa from their neighbours to sell in Harare. They would pay about $5/basin for the ishwa although they often could buy small amounts. Several households bought ishwa for their own consumption. They purchased 1-4 cups from once or twice per week to once or twice per season. One of these households bought from the Harare markets because their neighbours do not sell locally because they would have to sell for a lower price than they can make at the markets.

Only one household sold birds. The birds sold for $0.80, $1.00 and $1.50 each depending on the size. One household said that no one sells birds in their area but they would pay $0.90/dove and $6.00/guinea fowl. Another household said that if they were to sell they might charge $0.20 - $0.30 each for small birds. However, there does not seem to be much marketing of birds. Other wildlife was generally not sold either, although one household had paid $10-12/hare and one household bought locusts for $0.10-0.20/plateful.

While madora is not sold it is however purchased by thirteen households. The madora generally cost about $2-2.50 for a small package. However, packaging as well as consumption varies because one household paid $14 for a bag of 10 packages every 3-6 months, another bought 4 packages/week for $8.50/package while another bought 1 kg every 3-4 months for $3 or more per kg.

TABLE 5.9 Marketing of Wildlife Products by Hshlds According to Remoteness Classification.

Wildlife	1 Least Remote		2 Average		3 Most Remote		Total Nr. of Hshlds	
	buy	sell	buy	sell	buy	sell	buy	sell
Birds	0	1	0	0	0	0	0	1
Mice	1	4	0	0	2	0	3	4
Hare	1	0	0	0	0	0	1	0
Ishwa	3	6	0	2	7	2	10	10
Locust	1	0	0	0	0	0	1	0
Madora	8	0	1	0	4	0	13	0
Total Nr. of Hshlds In Wildlife Mkt[14]	7 (5)	3	0 (1)	1	8 (1)	1	15 (7)	5

TABLE 5.10 Reasons Cited For Not Consuming Wildlife.

Reasons	Nr. of Hshlds Citing Reasons
Taste Preference	4
Religion	7
No One To Collect	7
Lack of Wildlife	17

[14]This row is not a summation of the table because some households sell or buy multiple items. The number in brackets represents households which buy and sell.

The income earned from selling wildlife may be small in comparison to total income. However it does appear to be considered important. This additional income is used to purchase items such as sugar, bread and soap. One household though did not feel that this income was significant and would not miss it if it was gone.

5.2.6 Reasons Not To Consume Small Wildlife

Of interest are the reasons why households chose not to consume certain species (Table 5.10). Taste preferences, and religion and social controls may influence the influence the household's choice to utilize wildlife. Lack of wildlife or no one to collect the wildlife may also prevent collection of wildlife even if desired.

Taste preference was cited by eight households as a reason they did not consume wildlife. For example, while tsambarafuta is eaten by children some adults do not like it because it is fatty. Two households did not collect mice and another did not buy mice because they could not differentiate them from rats.

Religious reasons were also cited by seven households as reasons they did not consume certain wildlife. If the elders did not consume wildlife due to religion then the other family members usually were scared to. Also, n'angas[15] do not consume wildlife. There seemed to be an environmental ethic with certain religions, particularly the Apostolic faith who believe that conservation is related to the Bible. Certain species are not consumed if they were declining in number. For example, one man said that mice used to be consumed but now they were not eating them in order to give them a chance to multiply. He said that they will also eventually stop collecting birds and locusts for

[15]A n'anga is a traditional healer.

the same reason. However, there was a lot of variation between households in which wildlife they could not eat due to religious reasons. Madora are not eaten by some because these are eaten by birds which are eaten by humans. Therefore they need to leave the madora if they want birds. Several others stated that they did not consume mice, birds, hares or mandere due to religious reasons. Wild pig was not eaten by one household because it is considered a filthy animal. Two households stated that they did not eat mammals that did not chew cud and have split hooves. Another household did not consume ishwa because when a person dies they are buried on a termite mound and they felt that the ishwa that come up may have been feeding on the corpse.

Resource use can also be influenced by sacred and social law. Sacred areas can affect use. Near Bapatu, there was a sacred area in the valley with kudu and buck. People are scared to hunt in this valley although some people do. One household mentioned that ishwa were considered sacred, a gift from God. Therefore they are a free resource and people are not restricted from use. People can take as much as they want and sell them but there is also social pressure on use. However another household who followed religious beliefs felt that they could not collect wildlife to sell, however they can collect it in bulk if it is for their own use. When questioned about resource controls in the area, the Munywira headman said that people can not go on another person's land without permission to collect. Also people do not collect what they can not consume. He said they never have problems with people trespassing or damaging their neighbour's resources such as their ishwa mound.

Physical circumstances may also influence collection. Seven households mentioned that hare, buck, wild pig and birds were not hunted because there was no one to hunt them. These wildlife are usually hunted by men or boys. However,

the man be may working elsewhere and the children may be attending school.

Low hunting rates for hares and especially buck and wild pig may also be due to under-reporting because these are illegal to hunt. These wildlife also require a hunting trip, equipment such as spears and sometimes dogs, while collection of other wildlife is opportunistic. However, it is more likely that the main reason for low hunting rates may be that these species are not very abundant due to settlement and clearing. Twenty four households (63%) mentioned a decline in small wildlife numbers. However, two people felt that there had been no change in small wildlife and one man even felt that the number of birds had increased because few people hunt them now. Some people had never seen a wild pig and did not feel there ever had been any. Others mentioned that there were no hares or buck around either.

Many people suggested that the small wildlife has left because of all the people and deforestation. Two households mentioned that locusts had declined because of spraying by Agritex. Another person suggested that wildlife decreases when crops are poor because there is nothing for the wildlife to feed on. They felt the wildlife had moved into the commercial farms which still contain habitat. Many people felt that there was no space for the wildlife to live even if it did come back.

This lack of wildlife was cited by 17 households as a reason not to collect particular wildlife. Because the wildlife is remote and difficult to find there is a great chance of failure on hunting trips. It is easier and quicker to go to the butchery instead therefore substitution is the response.

The most common reasons cited by households in the lower wealth groups were religious reasons and no one to collect

the wildlife as well as lack of the wildlife in the area (Table 5.11). However, in the higher wealth group a much greater proportion cited lack of the wildlife in the area as well as taste preferences as their reasons not to consume.

In the most remote areas religion and no one to collect the wildlife were more commonly cited as reasons not to consume wildlife (Table 5.12). In the least remote areas, however, lack of wildlife and taste preferences were more common.

5.2.7 Attitudes Towards Small Wildlife

Several households (24) indicated that they would like to have more wildlife around (Table 5.13). The highest proportion of these households were in the higher wealth grouping. Some people, though, did not wish to have more wildlife around because it was a hazard to their crops or it was dangerous (large game). However, others suggested that the wildlife is easy to control by hunting or collecting and then they can also benefit. People indicated that they would like to have more wildlife around because then they could substitute it for meat which is expensive.

However, some people also suggested that they would like to have wildlife in the environment for their children to see and because they find the wildlife, such as birds, attractive. Others felt that the wildlife had a right to exist, although some people expressed concern over where the wildlife would live due to lack of habitat.

Many people considered the wildlife important to their diets and felt that the income, if they sold wildlife, was also helpful. However, a couple of people did not feel that the wildlife was important to their diets and incomes and they could do without it.

TABLE 5.11 Number of Hshlds In Each Wealth Grouping Citing Particular Reasons For Not Consuming Certain Wildlife.

Reasons	Lower Wealth Grouping	Middle Wealth Grouping	Higher Wealth Grouping	Total Nr. of Hshlds
Lack of Wildlife	5	3	9	17
Taste Preference	2	2	4	8
Religion	4	2	1	7
No One To Collect	4	2	1	7

TABLE 5.12 Number of Hshlds In Each Remoteness Category Citing Particular Reasons For Not Consuming Certain Wildlife.

Reasons	1 Least Remote	2 Average	3 Most Remote	Total Nr. of Hshlds
Lack of Wildlife	5	3	2	10
Taste Preference	4	0	2	6
Religion	1	2	4	7
No One To Collect	3	3	5	11

TABLE 5.13 Number of Hshlds Who Desire Wildlife According To Wealth Grouping.

Wealth Grouping	Lower Wealth Grouping	Middle Wealth Grouping	Higher Wealth Grouping	No Grouping	Total Nr. of Hshlds
Nr. of Hshlds That Desire Wildlife	4	4	14	2	24

5.2.8 Willingness To Pay (WTP)

Ten households were selected during their interview to be asked Willingness To Pay (WTP) questions. Most of the people asked the WTP questions were able to respond[16]. However, some people did have difficulty coming up with a value and one person could not respond. Responses ranged from $5/month to $400 as a one time payment. Most households were willing to pay because they could substitute for meat expenditure[17]. One household suggested $40/month for a project to increase wildlife because they presently pay $40/week for meat. Another household also saw wildlife as a substitute and would pay $20/month. Other households were willing to pay $5/month and $10/month. At one household the father had difficulty determining what he would pay. However, the son suggested $400 as a one time payment and the father decided that he would be willing to pay $100/6 months. In order to be able to legally hunt hares and buck a household suggested that they would pay $10/month.

Some households desired wildlife even if they did not use it for meat. A value of $20/month was suggested by one household and three others suggested $50-60/month. Finally one household was not able to give a WTP value but stated that she would pay whatever everyone else had to.

5.2.9 Discussion of Chinamura Results

The results of the field survey, while not conclusive, do provide several possible insights into wildlife utilization and importance. Household's generally did not utilize a large number of wildlife or in great numbers. However, some amount of wildlife did play a role in every household. Certain species, such as birds, mice and ishwa, did seem

[16]WTP responses are in the comments section of Table D.1, Appendix D.

[17]Meat expenditure for some households are found in Table D.2, Appendix D.

quite significant when they were available. The small wildlife were mostly used for home consumption. However, if they were collected in surplus they were marketed. This small additional income seemed to be considered helpful.

Wildlife was generally collected from around the household and was usually undertaken in conjunction with other tasks. However, some respondents did make occasional trips elsewhere for certain species. Seasonality was also a strong factor in collection. While some species may be collected year round, others are only collected for during a certain period. This is especially true with the insect species, although mice also are subject to some seasonality in collection.

This study was conducted during the harvest and later in the dry season. The time of gathering data may be affected by when it is collected because quantities may be hard for households to recall for the year. During the harvest and during the rainy season, particularly at the onset of the rains, appears to be when the most wildlife collection occurs.

A greater proportion of households in the higher wealth grouping utilized wildlife than in the lower wealth grouping. These higher wealth households also utilized a greater variety of wildlife. The higher wealth households however may not face labour constraints that may be connected with lower wealth households. Perhaps, these households are also more ambitious which is also why they are wealthier. These households may also be large and therefore require a greater food supply. Taste preferences do not seem to bias against wildlife with the higher wealth households.

While the higher wealth households cited lack of wildlife as a reason not to collect, this may be because these

households also tend to be located near main roads and densely populated areas. However, lack of wildlife is also cited by lower wealth households which may suggest that they are located in environmentally degraded regions which do not attract wildlife. The environmental quality of the area was not explored in this study. Generally, though, most people felt that wildlife had decreased in the area, due to population pressure and not due to over-hunting.

Wildlife utilization in least remote areas was actually slightly higher than in more remote areas. However, this may not reflect availability of wildlife but may be due to other factors such as lack of labour in households located in remote areas. Also, there were a greater number of people who did not consume due to religious reasons in the more remote areas. Therefore they are not utilizing the wildlife even if it is available.

Taste preferences was cited more often in the least remote areas as a reason not to consume wildlife. These households have greater access to shops and can purchase items, therefore their tastes may be influenced. Also, wildlife is hard to collect therefore if the butchery is nearby and the household is wealthy then it is easier to buy meat. Several households also mentioned that there was no one to collect the wildlife or that it was difficult to collect so not used.

Religious restrictions and beliefs differed between households which suggests that a variety of religions may occur in any area. This variety may be due to immigration of people from other areas or possibly even neighbouring countries. As a result there may not be a strong religious cohesion between the residents of any area therefore traditional religious controls and taboos may not be followed.

The amount of marketing varied throughout the area. Marketing of wildlife may be a factor of the abundance of wildlife in the area and amount of surplus collected by households. Much of the wildlife is never bought or sold. If there was not a market for the wildlife in the area then households in the area often had difficulty stating what price they might charge if they sold. Where markets did exist, purchasing wildlife was practiced more often by higher wealth households, although selling by these households was rare. These households may have more cash income to spare and therefore can buy more wildlife. However they may also have larger households and therefore require additional food. Large households may not have surplus to sell which could account for less selling. Remoteness may also be a factor influencing marketing. The most purchasing occurred in the most remote areas. Households in more remote areas do not have the same access to stores. Access to meat supplies and other products for variety may be limited. Therefore, if these households do not collect the wildlife themselves then they may purchase it for variety or to supplement their protein requirements.

In terms of use, several households did indicate that they desired more wildlife so that they could substitute it for meat. The majority of these households were in the high wealth grouping. Households in the lower wealth grouping seemed more concerned with crop destruction by wildlife perhaps indicating their greater vulnerability. However, several households in all wealth groupings also felt that wildlife was important to have in the environment for existence, spiritual, aesthetic and bequest reasons. The men seemed more interested in having wildlife in the area than the women.

The field study also gave some insight into the potential success of non-market valuation methods. Because time

tradeoffs were not significant and collection expenditure minimal, TCM is not suitable as an appropriate valuation method. Minimal time seems to involved with most collection of wildlife. Also many of the collection activities occur concurrently therefore it may be difficult to derive time spent. This collection is also highly variable or a matter of circumstance. TCM could only be used if the time tradeoff with harvesting could be measured and given a value. This however would be very difficult because tradeoffs with agricultural activities may not necessarily result in lower yield or lost value because the time would probably be compensated for or agricultural activities may not really be interrupted.

The only potential for TCM would be with respect to specific hunting trips which are occasionally organized for hares and bucks and could perhaps be documented. The number of days of the trip, equipment and food could be used as variables. However, the time involved in the trip does not necessarily mean lost income or decreased agricultural production. Long hunting trips tend to be scheduled during the off-season when there is little agricultural work and therefore opportunity costs may be low. Also, most farmers work their land to provide for their household and therefore do not receive a wage. A hunting trip would be part of the many activities which provide for the household. Also as mentioned earlier, expenditure on equipment is minimal if not zero. Food expenditure is also minimal and perhaps zero because food would either be brought from home or acquired along the way. The only relevant expense might be any food purchases. Therefore, TCM does not appear to have a significant potential as a suitable valuation method.

Similarly hedonic modelling also does not have great potential. Hedonic modelling is generally based on the assumption that the land and environment have value and this

is based on land ownership on property rights. However a system of property rights is absent in communal areas and land tenure is granted but the land is not actually owned and can not be sold so there is no market price for the land. As a result there is no basis for Hedonic because the decrease in value of the land as a result of environmental degradation can not actually be measured and compared.

From the limited attempts in this study, WTP questions for CV appear to be possible and did not meet with non-response as was expected. It appeared that people were willing to pay some amount for increased wildlife although the accuracy of their responses was not tested. However, success with WTP questions may depend on the household's market experience. In areas without a market for wildlife products, households that were asked to state the price they would charge to sell individual wildlife, often had difficulty. Therefore they may also have difficulty estimating a WTP. Other households, however, were able to estimate a price. With careful research and planning CV excercises should be able to extract values for small wildlife resources.

5.3 NYANGA STUDY AREA

5.3.1 Area Description

In the Nyanga study, a total of 18 households were interviewed in 5 villages located in 3 very separate wards. The field data are documented in Table D.3, appendix D. Within Sanyatwe ward, two households were interviewed in Nyahumbe village, four in Nhyari village and four in Gukutu. Six households were interviewed in Nhonheyapundi village in Gone ward and two in Nyhokwe in Ruchera ward. This broad cross-section was intended to provide some general

comparison with Chinamura. However, due to the small sample size the analysis of the data will not be as extensive as with the Chinamura data.

Sanyatwe ward is a resettlement area established in 1980. Villages were small consisting of 10-12 households. Nyahumbe and Nhyari, were classified as most remote. They were very remote from any business centres and quite distant from the main road. Road access was very poor and there did not appear to be ownership of any vehicles. Gukutu village, in contrast, was located on the main road between Landon stores on the highway and Bonda, a nearby township.

Nhonheyapundi village, in Gonde ward, was located near Nyanga township. Therefore this village was least remote with easy access to large markets. Many of these households had large houses with a couple rooms and concrete foundations. Also, many of the households have an absent member working in Harare or elsewhere. As a result, some households also had workers.

Nyhokwe village, in Ruchera ward, was visited because it was most remote. This resettlement area was established in 1983. While located along a main road, it was however very distant from other villages and business centres. In contrast to the other areas visited though, there was not a high density of people.

5.3.2 Small Wildlife Utilization

There seemed to be less wildlife utilization in this area. However, this result may be due to the small sample. While mice and locusts seemed to be utilized by a majority of households, other wildlife was much less commonly utilized (Table 5.14). The species utilized in this study are incorporated in Table C.2, Appendix C. A timeline of

TABLE 5.14 Number of Hshlds Utilizing Small Wildlife

Wildlife[18]	Number of Households
Birds	6
Guinea Fowl	3
Mice	12
Hare	1
Buck	3
Ishwa	5
Huhuri	3
Locust	14
Cricket	4
Madora	5
Motho	1

[18]Some wildlife (ishwa, madora) was purchased as well as collected.

agricultural activities and wildlife seasons is included in Table D.4, Appendix D.

Mice were used by 12 households. Collection would take place nearly every day during harvesting activities and result in 0-10/day. Although one household only collected a total of three mice in their last season. About half of the households trapped after the harvest season. They might trap every day or only a couple times a week and collect 0-4/day.

Birds were collected by some households with some households specifically catching guinea fowl. Birds were caught by circumstance or a few households made a couple trips a week and might therefore might get 2-5/wk. In one household, the children, collected young birds from nests. Guinea fowl were rarely caught although one household regularly made trips every couple weeks and caught 1-2/trip. Another household only collected the eggs. Hare and buck were also very rare, perhaps amounting to 1/yr for those who did hunt. However, the household that regularly caught guinea fowl also reported on buck and hare per month.

Locusts were collected throughout the areas by 14 households. These, like mice, were also collected during harvest. They were collected every day or a couple times a week. While some collected less than 10/day, some households collected 0.5-1.0 L. However, in several households, locusts were just collected by children as a game.

The other insects, such as ishwa, huhuri, crickets, madora and motho were not utilized by many households. However, this may have veen due to limited availability of these. Madora was only collected by some households, and bought from the store by others. Collection involved several hours. In one area the women organized a trip once a year

because of the distance. They would leave at 5 or 6 AM and return noon. In another area, they did not have to travel far but would only make one trip per year, which would take all day.

Most wildlife, including mice, birds and locusts, was usually eaten as a snack. however, if collected in large numbers mice could be used as relish particularly by children. One household also said that a buck could be a source of permanent relish for a long time although buck were not commonly caught by most other households.

There was little evidence of marketing of wildlife in any of the areas. However, this may be because of limited availability or a result of the small sample size. One household did buy ishwa once or twice per season from others in the area. They purchased 2 cups each time for $1.50/cup. Another household would occasionally buy 1 or 2 cups from the Rusape market for $1/cup. Some households purchased madora from nearby stores. One household even purchased a piece of kudu (over 1 kg) every year from another household for $10.

Wealth groupings and remoteness did not seem to influence use. The most commonly stated reason to consume was because there was no one to collect wildlife. Limited availability seemed to also be a main limiting reason. Several households stated that there used to be small game in the area. However, this small game had now moved to protected areas because of the increase of residents in the area.

Religious reasons were also commonly cited. Some species were not consumed because they were considered unclean by their religion. However other species were clean but were still forbidden by their religion. According to one person, the Old Testament restricts use but the New Testament allows use, however he chose not to use wildlife because he was not

interested. Religion provides protection for the wildlife because they are not allowed to use some wildlife and they are not interested in killing other wildlife because they are taught to appreciate it. There are also sacred areas where killing of wildlife is prohibited although a few people do hunt in this area.

Social reasons were stated by some. People can kill wildlife that is on their property however not the wildlife in the forest. Also they only kill wildlife that they are going to use. Some people may break this rule but very few. Certain species may also have restrictions on their use. For example, there is a particular bird in the area that kills snakes therefore it is protected. Also, baboons are protected because people do not eat them.

5.3.3 Political Arrangements

In addition to the regular questions about wildlife, several households throughout the various villages were questioned about political processes within their village. The purpose of these questions was to determine how community decisions are made about projects and to see if people would be comfortable with a referendum or voting approach to CV.

In Sanyatwe resettlement area, there is a chairman. This chairman is in charge of the resources in the area, allocates the land being resettled and determines the number of residents in the resettlement area. The chairman administers any projects and makes decisions to allocate resources to the project. The villagers do gather to discuss issues such as grazing or projects. They come up with a group decision based on their debate over facts and problems. If a group consensus can not be reached then there is a vote. The chairman acts as a monitor for the debate, however the group makes the decision. Ruchera ward

is also a resettlement area. Again, decision-making is done through village gatherings with a vote if necessary.

In communal areas the political setup is different than the resettlement area, however the political processes are similar. In Gonde ward, to decide on a project or issue the village would gather and discuss the facts. The headman acts as a chair for the discussion however the final decision is made by the group. The decision is based on group consensus, however if there is much debate then there is a vote. The headman of the village then presents the group's decision to the councillor who approaches the local government.

5.3.4 Discussion of Nyanga Results

The Nyanga results are not particularly relevant on their own, however their significance is in comparison or contrast to the Chinamura results. The findings in Nyanga suggest that, as suspected, different species have priority in different areas. Wildlife use did not seem to be as prevalent as in Chinamura in variety or quantity, although this may be due to the small sample size. In particular, mice and birds were collected in much smaller quantities and frequency in Nyanga. Also, insect use was much lower than in Chinamura.

However, if wildlife utilization is more limited in Nyanga it may be mainly due to limited availability of certain species and not a lack of desire to consume. Nyanga district is heavily populated therefore wildlife may not be present in large numbers. No one to collect the wildlife also seemed to be a limiting factor in wildlife utilization. In many households the husband works and lives elsewhere, such as in Harare and is therefore only home occasionally. As a result, there is no one to hunt which is traditionally the man's role.

Very little marketing seemed to occur in Nyanga. However if there is a lack of wildlife then there would be less marketing because it is usually the surplus that is sold. Remoteness or access to markets may influence marketing however that was not determined in the Nyanga study. It is possible though that households with less cash income would not buy wildlife therefore markets for wildlife products may not exist, even informally. However, it is not known if households in Nyanga have a lower cash income than in Chinamura.

In Nyanga, there also seemed to be less interest in having more wildlife around. Perhaps this lack of interest is because wildlife does not have high use value to the households. Existence value may be a luxury and if people are richer in Chinamura then they may have the freedom to have non-use values. Long-term vs. short-term survival concerns will influence the values that are placed on resources. Several households in Nyanga mentioned that they would even prefer not to have wildlife in the area because it is destructive to crops. People in Nyanga may be more dependent on agriculture due to limited income or less market access. As a result they are more affected by outside factors and are more risk adverse. Crop destruction by wildlife may be a big enough concern that they would rather forego wildlife because they can not afford crop loss. Nyanga is located in a favourable agroecological region, however other factors may be involved.

5.4 OPPORTUNISTIC INTERVIEWS

The following interviews were not conducted as part of the intended field studies but occurred opportunistically when visiting other rural areas. However, a brief mention of

these interviews is included because they indirectly contributed to developing the overall background.

In Wedza, a clinic was visited, and the nurse as well as a man who was present, contributed to a discussion. They listed several small wildlife that are used including mice, hares, several types of birds such as doves, guinea fowl and partridges, and several insects including crickets, mopane worms, termites, mandere and cicadas. They did not feel that there had been any change in wildlife populations over time and there was no concern about these resources. The nurse felt that if these resources were gone then the people would just do without them however she did mention that during drought they become more important as a relish. Another interview found that mice and birds were used. One man felt that wildlife was very important for meat. He hunted lots of hares as well as duiker, steenbok and impala. He said that people used to be intimidated by the government not to hunt. A group interview of men, women and children at a local shop found that a large variety of small wildlife was suggested. This wildlife included doves, guinea fowl, wild ducks and other birds, as well as small game such as wild pig, hares, duiker, steenbok and bimha, also large game such as kudu and antelope and insects including ishwa, tsambarafuta, grasshoppers, locusts and termites. A final household interview also indicated use of caterpillars, locusts, mice and hares with some marketing of mice at the beer hall and hares to the neighbour.

In Mutoko town, one man said that his brother-in-law hunts birds part-time to sell to the local market as well as exporting for $75-80 each. It may be possible that he is selling exotic birds in the pet trade. A teacher at a rural school was also interviewed and listed hares, doves, guinea fowl, partridges, buck, termites and ishwa as being used in the area. He felt that hares and wild pigs had decreased

and in particular wild pigs were fewer because they were overhunted. He said that most hunting by people was done for personal use not income. Another group interview of four men found that mice, guinea fowl, doves, wild duck, hares, caterpillars, termites, ishwa and ants were used. They said that some people may eat bullfrogs, rats and rock lizards but that was a matter of personal taste. Also, chameleons, snakes, caterpillars and ants are used in medicine. Use of small wildlife in traditional medicine was not really explored in the two field studies, but could represent another important use. Finally, two children were interviewed while herding. They stated that they hunt mice, hares and birds as they come home from school or while herding. One of the boys was even carrying a slingshot. They said that they may catch up to 10 birds in a day and he had eaten one the previous day. The children's comments suggest that hunting of small wildlife by children may occur regularily and could be significant.

5.5 CONCLUSIONS

Evidence suggests that the use of small wildlife by communal area households is significant. While large quantities may not be utilized, small amounts of various wildlife contributes to the household diet. The importance or actual extent of this use may not be fully recognized even by the households themselves. In particular the role of these resources during drought or the importance of these snacks to children's diets may be more significant.

As expected, these studies show wildlife use differs between different areas. Even within an area, this use differs between villages and even households. The availability and variety of small wildlife will vary between areas for ecological regions such as available habitat and climate.

Human factors such as population density and agricultural clearing will also affect wildlife population. The actual time of collection will also vary between different areas because the seasons of wildlife availability and agricultural activities will also vary slightly throughout the country. As well as wildlife availability, use is also influenced by religious, social and taste reasons or the presence of someone to collect.

The amount of marketing also differs between and within areas and villages. A lack of wildlife may result in less marketing because there is no surplus to sell. However. limited access to formal markets such as at local business centres or cities does not necessarily result in less marketing. On the contrary, informal trading may flourish because there is less access to substitutes at stores. In fact access to markets may discourage wildlife utilization because it is easier to purchase meat, especially if wildlife is difficult to find.

The general belief is that the amount of wildlife in the communal areas has decreased due to agricultural clearing and increased residency. These are permanent factors which cannot be easily changed, therefore there may not be the potential to increase wildlife in an area. Also, there may be resistance against increasing wildlife by those who do not use the wildlife or see it as an agricultural pest. Therefore attitudes towards wildlife in an area are important to determine. However, many people do value wildlife for its non-use as well as its use values and would encourage attempts to increase the wildlife.

While TCM and HPM do not appear to be suitable valuation methods to apply to valuing small wildlife in communal area, CV does have potential. In areas with interest in wildlife, such as in Chinamura, WTP questions should be possible. However, in areas with little interest or use of wildlife,

particularily where wildlife is seen as a pest such as in Nyanga, attempting WTP questions may be irrelevant. Differences between areas as pointed out earlier prevent a blanket approach to valuation in different areas. However, recognition of different conditions and factors influencing use will increase the success of the valuation. Also, the data from these studies should provide some general background for initially planning the valuation approach.

6.0 FRAMEWORK

6.1 CONCEPTUAL FRAMEWORK

6.1.1 Household Production Model for Communal Area Household in Zimbabwe.

Household production theory, which was introduced in Chapter 3, will be used to develop a contextual framework for household decision making in a Zimbabwean communal area[1]. A description of the socioeconomic situation of communal area households will be formed and presented within the Household Production Function framework. This description will be based on Zimbabwean literature as well as field observation. This framework will then be used to analyze the value of wildlife to a household in a communal area in Zimbabwe. This study will focus on the role of wildlife in household use through the contribution of wildlife resources to the basic needs satisfaction of the household. Household demand theory will then be used to conceptualize how to derive a value for wildlife. A brief discussion will relate this to the valuation of forest resources, however this study focuses on the valuation of the wildlife and does not make any further attempts to apply this to valuation of the forest.

Household production theory cannot be used to measure non-use values (Braden & Kolstad, 1991). Therefore, the use of wildlife is examined to see its value to the household and possible household production valuation approaches. The household production framework also provides the framework to consider non-market valuation methods. The following

[1]This model is designed through adaptation of a combination of ideas presented in Gaiha (1991), Singh et al (1986) and Strauss (1986).

description of communal area households provides the characteristics that will be incorporated into the household model.

This study focuses on the agricultural household in a communal area (or resettlement area[2]) in Zimbabwe. Generally, farm households are large, consisting of about ten members including two non-residents who work elsewhere (MLARR, 1990). The agricultural production systems in communal areas are characterized by a mix of food production for own consumption as well as for the market (Bradley & Dewees, 1993). Agriculture consists of cropping and vegetable growing as well as livestock management.

Farm holdings average from 0.9 ha to 2.0 or 3.0 ha in the poorer regions and typically include 3.0 ha of arable land which is often located further than one kilometre from the household (Bratton, 1987; Reh et al, 1988; Sithole & Attwood, 1990). Garden plots vary in size and may be located near a source of water. Literature implies that farmers do not have sufficient land to meet their needs. Dewees (1992) suggests that the availability of arable land is a major constraint in high potential areas although in low potential areas the lack of grazing land is at least as serious a constraint. However, Watson (1994) found that respondents in her study did not feel that lack of land was a restraining factor. Nearby communal grazing areas support the community's livestock. These are savanna areas opened up by deforestation and agricultural clearing (Campbell *et al* 1991). However this land is often overstocked resulting in soil erosion. Trees and other products in these areas are also used communally under different forms of social control.

[2]References to communal areas also include resettlement areas, although there are some differences between communal and resettlement areas.

The main crops grown include: maize, sorghum, finger and bullrush millet, ground nuts, sunflowers and cotton. Vegetables such as tomatoes, pumpkins, squash, kale and others may be intercropped with the crops or grown in the garden patches. Sugar cane, bananas, mangoes, oranges and other fruits are also grown. This produce is essential to supplying the households basic food needs[3]. However, much is also transported to local and urban markets. This income provides an important source of cash.

Livestock is generally kept for household use. The patterns of livestock ownership and distribution varies across and within Zimbabwe's natural regions (Christensen & Zindi, 1991; Zindi & Stack, 1991). Cattle represent a source of wealth and generally are not consumed but kept for draught power, milk and manure. They also represent a form of insurance and can be sold if necessary or may be used in the payment of lobola[4] (Scoones, 1992). Other livestock includes goats, chickens, rabbits, birds and occasionally donkeys. Goats are valued for their meat and hides, although some households use the milk. Some of the smaller livestock may be slaughtered for household meat. Sithole & Attwood (1990) found that in their study area the average household owned seven cattle and seven goats, however one in five households hired draft animals. Livestock also provide income. Zindi & Stack (1991) found that this income was mostly used to purchase grains or mealie meal, as well as for school fees, clothes, farm inputs, medical expenses and lobola.

The main input into production is family labour with simple technical inputs (Rukuni & Bernsten, 1988; Sithole & Attwood, 1990). However the returns to labour are very low

[3]However, some drier areas often experience droughts and the government must supply food relief.

[4]This bride price is a sum of money, usually in conjunction with cattle, that must be paid to the parents of the bride by the prospective groom.

(Sithole & Attwood, 1990). Women are responsible for most of the household as well as agricultural tasks and therefore household food security. Children are also involved in many household and agricultural tasks such as collecting fuelwood and water or herding cattle.

Little or no capital input may be involved in agricultural production although seed[5], fertilizer or additional labour may be purchased. Variable inputs into farming are dominated by draft animals which account for over 40 % of total variable inputs and fertilizers which comprise about 25 % (Sithole & Attwood, 1990). Cattle and to some degree, donkeys, play an important role in providing other inputs such as manure, draught and transport (Cousins *et al*, 1988). The success of crop outputs depends on access to the inputs at the optimal times (Ashworth, 1990; Cousins, 1990; Cummings & Bond, 1991; Jackson, 1989; Scoones, 1989; Shumba, 1984; Watson, 1994). Households without cattle may have to wait until others finish planting before they can borrow cattle. However these late crops are the often hardest hit by drought. Fertilizer is also critical to yield especially in areas of poor soil.

The households also utilize their surrounding woodlands for timber and non-timber products. Small wildlife and insects are the non-timber products of interest in this study. Due to limited access to meat and protein for many rural households, wildlife resources are an important contribution to household food security (Chimedza, 1989). Family members contribute some labour and minimum equipment to collect and harvest these products. Different ages or genders collect different products. Generally collection is the task of women and children while hunting is done by the men and boys. This opportunistic collection is done in conjunction

[5]In disadvantaged areas, seed packets may be distributed by the government.

with main tasks such as herding, gathering fuelwood, collecting water, or harvesting.

Many households in communal areas face income constraints. Household income has been found to vary considerably between households (Jackson & Collier, 1988; Sithole & Attwood, 1990; Stanning, 1989; Rakuni & Bernsten, 1988). Jackson and Collier (1988) found a range of Z$28 to Z$771, however they also found that 50 % of households received less than Z$137 per capita and 75 % were under Z$248. Jackson and Collier (1991) estimated an annual mean aggregate income of Z$701 per household or Z$227 per capita. If non-cash flows and gifts are excluded, annual mean aggregate cash income is Z$421 per household or Z$130 per capital. Sithole & Attwood (1990) found annual gross farm income varied from Z$600 to Z$2 000 per household[6] with an average of Z$1 288. Allowing for variable costs of about Z$500 per farm and overhead costs of about Z$60, average net farm income was Z$735 and average non-farm income was Z$375 for a total net household income of Z$1 110. Mudimu *et al* (1990) found mean annual per capita incomes in their two study areas to be Z$140 and Z$153. The value of production for home consumption is estimated to be from 35% to 50% of total household per capita income. This home-use production accounts for a larger portion of income (70%) in lower income households than higher income households (55-65%) which have other income sources.

The factors influencing income are the basic soil and climatic characteristics and size of the farm area as well as the level of non-farm incomes received (Sithole & Attwood, 1990). Socio-economics differ between ecological zones. The main source of income is sale of agricultural crops (Mudimu *et al*, 1990) particularily maize, groundnuts,

[6]The average farm household surveyed in their study had ten members, although in two areas the average household had twelve members.

finger and pearl millet and other crops in smaller quantities such as bambara nuts, sunflowers and cotton. Cattle also contribute a substantial although not primordial amount to household income (cash and non-cash) (Jackson & Collier, 1991; Sithole & Attwood, 1990). Mudimu *et al* (1990) found that generation of cash income was dominated by non-farm and off-farm income generating activities. Sithole & Attwood (1990) found that vegetables are sold by 38 % of farmers, while 26% brew beer and 19 % receive remittances. Many households have absentee members, usually the male, who are employed in towns or cities. These households then receive remittances from these absent members. Another source of income or wealth may be lobola. Household incomes may be also be supplemented by remittances or gifts from other relatives. Extended family links often mean that a member who is well off is expected to help out less well of family members. Some people also earn extra income by marketing products from their surroundings.

Through agricultural production and harvesting of products from the surroundings many of the basic needs of the household are met. However, households in communal areas do not subsist solely on what they produce on their farms (Mudimu *et al*, 1990). Products and services are also purchased from outside. These may include construction materials; agricultural inputs such as seed and fertilizer; school fees; milling fees[7]; food items such as oil, sugar, bread, meat and snacks such as chips, cookies and soft drinks; as well as other items such as clothing and soap. Mudimu *et al* (1990) found that food and clothing expenditures amounted to 60 - 70% of household income and this was generally across almost all income groups. This purchased portion is therefore critical to the households needs. However, agricultural input purchases were found to

[7]The staple food item maize is ground into mealie meal which involves milling charges.

be low, which may be because there is little income left after meeting food and clothing requirements.

This household description can provides the background for developing a Zimbabwean Household Production Function model. The household utility function is specified in which utility is posited to depend on consumption of food, **F**, (home-production, purchased or supplied by relatives or government), consumption of other goods, **G**, (clothing, basic supplies, construction supplies, agricultural inputs, milling fees, school fees, and other services), health, **H**, and leisure, **R**, among other things. The vector **F** includes purchased food, f_1, as well as food produced by the household, f_2, food gifts, f_3, and collected food products such as wildlife, **w**. The utility function is:

$$U = U(F,G,H,R) \qquad (1)$$

This **U** is maximized subject to a "full" income constraint[8] and a set of production functions. The "full" income would be $Y = p_1 * f_1 + p_G * G$. **Y** is "full" income including income from crops, wages from employed household members and cash remittances. p_1 is the price of purchased food, f_1, and p_G is the price of other goods, **G**.

Production functions may include health and nutrition, and also fertility and longevity. This study will consider the production of what will be termed Household Basic Needs Satisfaction, **S**, that is, the household utility as seen to be satisfied by meeting at least the basic needs such as food security and purchase of necessary goods. Wildlife contributes to this utility either directly as a source of protein or by providing income to buy food and other goods. The qualities offered by wildlife are as an input to food security and possibly income. Therefore wildlife

[8]This may be hard to value if labour is for household production and does not receive a wage or if payment is through bartering.

contributes to utility. The production function is represented as:

$$(2) \qquad S = (f_1, f_2(g,L,K), f_3, w(g,L,K), G)$$

Therefore the household's basic needs satisfaction, **S**, is produced by consumption of purchased food, f_1, produced food, f_2, food gifts, f_3, wildlife, **w**, and other goods, **G**. The production of food by household agricultural production requires inputs, **g** (seed and fertilizer), labour, **L** (purchased and household labour), and capital, **K** (plough, draught power). Collection of wildlife may also require inputs, **g** (bait), labour, **L** (household) and capital (weapons, traps).

Production decisions involve minimizing the cost of production, $c = p_g * g + P_L * L$ (where P_L is the price of labour) subject to time and technology constraints given **S** and **K**. The following cost function results from manipulation of equations:

$$C = f(p_g, P_L, S; K) \qquad (3)$$

The production and consumption decisions are integrated by the household to maximize utility through production of goods while minimizing the cost of inputs.

The conceptual household production model that is constructed above for this study forms the framework for designing subsequent empirical studies that could be done to value the wildlife resources. Once determined, the information on these wildlife values could be used in estimating the total forest value. This aspect of the value of forest would involve considering the role that the forest plays in providing habitat for the wildlife. While this is beyond the scope of this study, a brief discussion follows.

The forest could be assessed according to its quantity and quality of habitat, carrying capacity, present wildlife levels and other biological features. The value of the forest could then be analyzed based on the value of the wildlife stocks present in the forest, the amount of wildlife harvested from the forest by the communal area, or the forest's potential wildlife capacity. These approaches would provide some means of assigning a wildlife-derived value to the forest. The values derived through some of the above approaches, could be used to compare the value of forest *in situ* for wildlife resources versus its use for fuel and other products. These wildlife and tree resources may also have potential but unrecognized value that is greater than the value of the alternatives and greater than the costs of acquiring these resources.

Empirical work to determine wildlife value would require data on demand for wildlife. These data could be collected through a detailed study of the communal area. One approach to valuing wildlife would be the derived demand approach which will be discussed next followed by a discussion of other possible approaches to valuing wildlife resources.

6.1.2 Derived Demand Approach

By making assumptions about certain characteristics of the production function[9], the marginal willingness to pay for wildlife can be calculated. The household's utilization of the wildlife resources specifies the demand for these resources. Derived demand theory can then be used to find a value for trees based on the utility or value of wildlife to households. The derived demand approach measures quantities of marketed products used by the household. The value of the product is the product price minus the costs of production. Campbell et al (1994) used this approach in a

[9]See Maler (1981) and Smith (1990).

study of two villages in Zimbabwe. They were able to determine values for a number of products.

In order to determine the household's production function, however, detailed information on flows of resources is required. However, this information may be difficult to collect. Campbell *et el* (1994) could not get accurate information on products collected occasionally and opportunistically. As a result they simplified their data collection to a limited range of frequently used products.

Documenting the flow of wildlife to households however, may not be that difficult in areas where the quantities and varieties utilized are limited. The field studies found that households were able to give an account of the wildlife they used and quantities. However, because much of the wildlife is collected occasionally and opportunistically the household may not actually be aware of the full amounts. A household diary of wildlife utilization may be the most accurate approach. The diary could record collection and consumption patterns. However, success would require cooperation because the diary would need to be kept by households for a year due to the seasonality of wildlife use. Detailed information collection should be possible with adequate research time although the costs of collecting this detail must be considered.

The study by Campbell *et al* (1994) also revealed some possible biases in collecting information. These included interviewer bias as a result of inconsistency between different interviewers in asking questions about quantities. There may also be respondent bias. If the respondent was suspicious about the purpose of the research they may have under or over estimated their quantities. There may also be unit bias because local units had to be converted to technical units and conversion factors may not have been appropriate. Seasonality bias due to high levels of

seasonal variation made it difficult to assess annual consumption rates.

These biases could affect collection of wildlife data also. Interviewer and respondent bias are also possibilities with collecting information on wildlife. In particular, respondents may under-report their wildlife quantities such as buck or hare if they feel this hunting is illegal. Respondents may also not want to admit using wild foods if they feel it is shameful. Strategic bias could also occur if the respondent downplays the importance of wildlife so that food relief supplies will not be decreased. Conversely some people may over estimate their wildlife quantities to make these quantities seem more worthwhile. Unit bias can be avoided by comparing amounts to standard container sizes. ie. establish a standard size of a dish, bowl or bucket and In particular, seasonality determines consumption therefore the time of data collection will influence the accuracy of the data.

The value of the product is its price minus its production costs, however Campbell *et al* (1994) found that labour was virtually the only input in producing woodland products. Tools were occasionally used but these had negligible costs, especially when considered over the life of the implement. The same is also true for collection of wildlife. Equipment costs are negligible and labour time is the main input. Therefore values would be the market price of the product minus labour costs.

Labour time, however, may be difficult to determine because much wildlife collection is opportunistic. Campbell *et al* (1994) used a variety of methods in their study of woodland products to determine labour time. Transportation costs were measured as the distance from the household to the

collection site multiplied by a travel rate[10] of five km/hr to give travel time per trip. Total travel time was therefore the number of trips times the travel time per trip. Total collection time was collection time per quantity[11] multiplied by the quantity collected. Total labour time therefore was the sum of travel time and collection time. If production time could not be determined then labour costs were assumed to be 40 % of the product's market value.

These methods of determining total labour time would only be applicable with certain wildlife species that involve a collection trip. For wildlife that is collected opportunistically or in conjunction with other tasks there would be no travel time. However an estimate of the actual time involved in collecting the individual wildlife could probably estimated. Total collection time at the end of the day or the end of the task would be based on the number collected. For example if a locust took one minute to catch out of harvesting time then if six locusts were caught throughout the day then six minutes of collection time are involved with collecting locusts. However, it is suspected that collection times for many species would be very minimal.

Even if labour time can be determined, labour wage rates may also be difficult because they may vary considerably. Campbell *et al* (1994) found a range of $5 - $25 per day. In some cases, benefits of activities would be negative if labour was given much value (Campbell, 1993). Also, labour availability is very seasonal (Gumbo *et al*, 1990; Zinyama, 1988). As a result of the lack of data on labour, this input is often downplayed or neglected (de Beer & Mcdermott, 1989; Moyo *et al*, 1992; Southgate, 1988). Assigning a wage

[10]This rate was based on survey data.

[11]This was also based on household interviews.

rate to the time spent collecting wildlife does not seem appropriate because these households are not working for a wage. In particular much of the collection is done by women and children. If men are available for collection then they are probably not employed off their farm and would therefore not be drawing a wage. In fact the value of time seems to hold a different meaning in communal areas than in urban areas where society and work is based on schedules.

Another concern is that current market and labour prices may not be appropriate for valuing large changes in areas where woodland is a major part of the local economy (Campbell *et al*, 1994). If large areas of woodland were removed in these areas, then woodland prices would increase and labour prices would decrease. Because woodland producers are also the consumers, studies using derived demand need to look at consumer surplus as well as producer surplus.

However, if woodland was removed and the wildlife decreased then probably less wildlife would be used and less would be sold because there would be less surplus. Prices may not increase because wildlife products do not appear to be significant enough to be very price elastic. However, it is possible that in certain areas there may be a strong dependence on wildlife and woodland products and therefore large changes could affect prices.

6.1.3 Other Valuation Approaches

The most basic approach to valuing wildlife resources would be to determine the market value for the wildlife and then multiply by the total quantity sold to get a total market value. However, while wildlife products may have a market value if there is a demand for such items in cities, this may not be a relevant value to assign to wildlife products used by communal households. Urban markets may be supplied by specific suppliers and not by communal households.

Hobane (1994) found that collectors came from urban areas to collect caterpillars in the rural areas. These collectors did this as a job. The market price in the city also may not be applicable if it is high to cater to people who can afford "specialities". These prices may be higher than communal households would actually pay in their area. If communal households actually had to pay this price for the wildlife they may not be able to afford it and would therefore exclude it from their consumption bundles. Therefore, prices in informal markets may be more appropriate. However, some households might only consume wildlife because access to these products in the forest is essentially free except for the time and labour in acquiring it. Therefore, finding a market-based value for wildlife excludes a large portion of the use value which is home consumption.

It is also assumed that market prices reflect scarcity. However, scarcity may instead result in less wildlife marketed instead of a change in price. Households may not be willing to pay a higher price for wildlife and will substitute away or just omit wildlife from their diet. Households that sell wildlife may be forced to quit because they do not have surplus or else they will have to sacrifice their own consumption in order to sell what they harvest. Therefore market prices may not actually reflect scarcity and may not be a suitable indicator of wildlife value.

Instead of determining a monetary value there are a wide range of non-monetary value indicators that could be used to measure demand for wildlife products (de Beer & Mcdermott, 1989). The demand for wildlife products could be proxied as a function of the frequency of consumption of the products or the frequency of collection. This collection and consumption could be compared to overall food intake. It may be possible to equate this percentage of wildlife intake

to total food value to get a value of wildlife. However, this would involve determining the total value of food which would include food that is produced at home as well as food expenditure.

A direct value could also be found by considering the time and effort expended obtaining wildlife products or the percent of household time budgets devoted to collecting wildlife. This collection time would have an opportunity cost of lost wage value. However there may not be an appropriate wage value to use. Collection time could be proxied by the imputed value of time in other activities such as food production or the value of foregone production (Bojo, 1993). However, the value of collection time would be affected by seasonality with a higher value on this time during the harvest season compared to the winter when there is less work. Time spent collecting wildlife could also be ranked against time spent on other activities to determine its relative importance. Values could also possibly be inferred from distance rather than time. The distance that people are willing to travel to find substitutes for resources that are exhausted near the homesite would indicate the demand. However it is suspected that if nearby wildlife is exhausted then the wildlife would not be used. Most collection seems to occur around the homesite with little effort required although occasional trips may occur to a specific collection site or for a specific wildlife.

It may also be possible to value wildlife resources by tracing their link with organized markets for other products (Campbell, 1993). One approach could be achieved by considering the value of substitute products that would have to be purchased from organized markets if these wildlife products were eliminated, i.e. their "replacement cost"[12] (Bojo et al, 1990). Thus crude estimates could be

[12]For a critical discussion of this application, refer to FAO (1992).

calculated by multiplying the quantity of wildlife products collected from the forest by the "farm gate price" or "replacement cost" of the wildlife product. However, since many of these products are not bought and sold then there may be an understatement or overestimate of local use value (Campbell et al, 1991; Behnhke, 1985; Bojo, 1993). In reality, financial constraints might not permit the farmer to switch to a marketed product, they may not choose to buy the marketed replacement good, or the good may be a necessity with no replacement or close substitute. Gumbo *et al* (1990) used the replacement cost method to derive a value for trees in Southern Zimbabwe. Campbell *et al* (1991) also used this method in conjunction with other valuation exercise to look of the value of trees in Zimbabwe.

However, with respect to wildlife products, "farm-gate" prices would not be appropriate. Wildlife is often used as a snack or extra therefore there would not be a replacement product. Also wildlife meat may be considered cheaper to buy than domestic meat. In the field study, one household that was asked about market prices for wildlife, compared prices to similar domestic animals but stated that the wildlife would be cheaper. Wildlife may be considered cheaper because it is essentially a free resource. Therefore "farm-gate" prices would be an overestimate of the value.

Alternatively, a value for wildlife products could be obtained if these products are bartered. Eventually, the bartering would lead to a link when a market good is bartered for a non-market good. This could be used as a basis for determining a value for the non-market good in terms of the market good. However, in the field study, wildlife products did not appear to be bartered and therefore this approach may be inappropriate.

Fines and penalties for misuse of resources may also be an indication of the value of the resources. However, the extent of enforcement would vary between areas. Also, much of the resource control appears to be social pressure not legal control.

Ranking of wildlife among other goods could also be used to determine a value. By ranking these goods among goods with a market value, an approximation of their value could be derived. This value would be somewhere in the range between the prices of the market goods ranked above and below the wildlife good. However this assumes that the prices of the market goods are also in relation to their household importance. Different resource areas could also be ranked to show the values of the different resources, including wildlife, in relation to each other. A value could be inferred if some of these resources were tied to a market value. This ranking may be done by direct questioning of individuals or through analysis of household surveys. Also PRA could be used to get a community ranking. Even if the ranking does not determine a monetary value, it seems to be an appropriate approach to determining value because it may not be the monetary value of wildlife that is relevant but rather the significance of the resource in relation to other tradeoffs.

Finally, while these approaches generally utilize some type of market connection to determine value, most small wildlife is probably used for subsistence therefore nonmarket use values need to be incorporated. Non-market valuation could involve application of techniques such as Travel Cost Modeling, Hedonic Price Modeling which are Household Production approaches to measuring use values or Contingent Valuation which can measure non-use as well as use values.

6.2 ANALYSIS OF NON-MARKET VALUATION METHODS IN A ZIMBABWEAN CONTEXT

The theoretical basis behind the non-market valuation methods, Travel Cost Modeling, Hedonic Price Modeling and Contingent Valuation was discussed in Chapter 3. As well, these methods were mentioned with respect to developing countries. These methods will now be examined more specifically with respect to their application to the valuation of small wildlife in communal areas in Zimbabwe.

6.2.1 Travel Cost Modeling (TCM)

Based on data about the processes involved in small wildlife collection and use, Travel Cost Modeling was found to be unsuitable for valuing small wildlife in communal area households in Zimbabwe. TCM involves distinct trips with time and expenditure that can be estimated. However, everyday trips and activities by a communal area household may not be easily identifiable and measurable in terms of costs. Small wildlife, in particular, is often collected opportunistically with few inputs.

The value of time presents a major problem as the concept of time and the cost of time may be different than in developed countries. In developed countries there may be time tradeoffs with paid labour time. However in rural areas in developing countries, there may not be an opportunity cost of time such as lost income because there is no alternative income. Also, wage rates are very low so the cost of the trip in terms of time costs would appear low.

However, there may be tradeoffs with other activities which are significant. Women are responsible for agricultural production, ensuring household food security as well as household duties. Therefore collection of wildlife, such as insects, may provide a conflict with time spent on other

activities. Children, however may collect wildlife, such as birds, while herding cattle therefore the collection does not interfere with their main activity or require additional time. Collection of mice from the stalks during harvest involves everybody but does not necessarily interfere significantly with the harvest. It may be that while the collection of the wildlife in the different cases requires some time tradeoff with other activities, there may be sufficient time that all activities can be still be incorporated.

TCM also does not account for multipurpose trips. It is very likely that a trip to hunt or harvest wildlife may also involve other tasks, such as collection of other non-timber products. Alternatively, the main purpose of the trip may not be to collect wildlife and this collection may just be a function of opportunity that arises on the trip. Because a hunting trip may not be easily isolated this further discourages the application of TCM.

People living at a subsistence or low income level are limited in their capital. Therefore, expenditure tends to be on necessary items that can not be produced by the household. Weapons or traps for hunting and collection are made from household or local materials and therefore does not involve additional costs. Food on hunting trips would be brought along or received from people along the way. Due to the nature of extended family and relationships there may be friends or relatives along the way to lodge with so it is doubtful that lodging would be an expense. As a result the actual costs of the trip would be low or non-existent.

Because there really may not be any substantial costs or time allotments, TCM does not appear to be appropriate to apply to small wildlife valuation in communal areas in Zimbabwe. However, it can not be entirely ruled out and could possibly be applicable for other resources which

involve specific trips although low costs would probably still limit its application. Probably the most suitable application of TCM, in Zimbabwe, would be in valuing recreational areas such as the National Parks.

6.2.2 Hedonic Price Modeling (HPM)

Due to a lack of property rights, Hedonic Price Modeling (HPM) also does not appear to be very applicable in communal areas in Zimbabwe. In Zimbabwe, land is held in customary tenure. The land is allocated to the household and is inherited by the sons. Unused land is reallocated to those who need it. While the individual may assume they have title to the land, legally they do not have title. As a result land can not be bought or sold. This effectively precludes application of HPM because there are no land or housing prices and no property markets. Therefore environmental qualities can not be incorporated into a property price.

Even if property could be assigned a price, income limitations would impose restrictions on choices. It may be possible that for many people, no additional income could be alotted to purchase land with better qualities such as greater wildlife opportunities in the area. Also, since these resources are public then purchasing land near wildlife opportunities would not prevent use by others in the area[13]. Therefore there may not be an incentive to pay a higher price for this land which would not have exclusive rights to these resources.

This lack of property rights and the ability the purchase desired qualities essentially eliminates HPM. The only way that it might be applicable would be through some modification. Perhaps, HPM could be used in a ranking

[13]Hunting and harvesting of these products would be rival use since use by an individual precludes further use by anyone else.

exercise of different areas or sites, where the preference for different qualities would be incorporated in the individual's ranking of the site. However market prices would not be involved unless these choices could be linked to a market and this would be difficult if land can not be bought or sold.

6.3 CONTINGENT VALUATION (CV)

6.3.1 Factors Affecting Application in Zimbabwe

Evidence from other developing country studies suggest that Contingent Valuation can be successfully applied to valuation in a developing country. CV is currently the only method available for measuring non-use values as well as use values and it also appears to be the most appropriate of the non-market valuation methods to apply in the valuation of small wildlife resources in communal areas in Zimbabwe. Interest is also growing in CV's potential applications to natural resource valuation in Zimbabwe. Campbell *et al* (1991) used CV to value woodlands and their products. The following examination will consider possible survey design, biases, considerations and modifications for the application of CV to communal areas and small wildlife resources. However, since no actual testing of CV occurred in the field studies, no definite conclusions can be stated, only possibilities.

One factor that may limit the application of CV is lack of education and illiteracy. In the two provinces where the studies were conducted, Mashonaland East and Manicaland provinces, 71 % and 76 % of people over the age of five had less than a grade 7 education (CSO, 1992). Of these 41 % and 49 % respectively had no education (CSO 1992). In Manicaland, 75 % of the population over 15 years of age were

literate (CSO, 1992). This included 69 % of females and 83 % of males (CSO, 1992). These rates tended to decrease significantly with age from 91 % for those 15-19 years to 32 % among those over 65 years of age. These literacy rates also varied significantly between the districts within the province. Socio-economic studies on communal areas households in Zimbabwe by Cutshall (1989; 1990) found that most of the adult population had no school experience. They found that the likelihood of no education was higher in older adults than younger adults. Most of those that did have education only had primary education. Also, males were more likely to have attended school than females.

However, while evidence suggests low levels of education and literacy is common in communal area households these factors should not prevent application of CV. Instead, these limiting factors should be considered when designing the survey for the targeted respondents. Oral interviews rather than written questionnaires would likely be more appropriate. Other methods of gathering information could also be used, such as PRA and RRA. CV should be possible with clear explanation at an appropriate level and sufficient time. Other CV studies in developing countries[14] with low levels of education have been successful.

Another factor affecting the success of CV questions will be people's attitudes towards wildlife. These attitudes will differ within and between areas. Where wildlife poses more of a threat to agriculture than a benefit, then WTP questions will be irrelevant. Due to household factors, such as tastes, religion, or lack of labour to collect wildlife, use values for small wildlife may be low. However, while low use values may discourage use of CV, non-use values may still be significant.

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[14]See section 3.3 for CV studies done in developing countries.

The choice of WTP or WTA will depend on the purpose of determining the wildlife value. However, income effects must be considered. Cash income is limited in some households which constrain a household's WTP bid while their WTA bid could be high. Also, income distribution is highly skewed in Zimbabwe and even within communal areas there are wide differentials (Jackson, 1989; Jackson & Collier, 1988; Moyo et al, 1992). Related to this income bias may be gender bias. Female respondents may not be willing to suggest a WTP value if they do not have access to the household's cash income and therefore could not pay. Female-headed households may also be poorer so their bids may be constrained. However, Stack & Chopak (1990) who conducted a study on household income patterns in Zimbabwe, found there was insufficient evidence to support the common assumption that female-headed households are a disadvantaged income group. Therefore due to skewed income distribution and possible gender effects the choice of question and its success could vary greatly within a sample.

While WTP and WTA bids may differ if the good in question is unique, small wildlife resources and insects would probably not be considered unique or rare. Therefore the elasticity of substitution would probably be large. In fact it already appears that a lot of substitution away from these goods has taken place. However while WTA would measure the cost of loss of wildlife resources this probably is not realistic because it is not likely that any form of compensation would be offered. Also it appears that these resources may already be gone in several areas. Therefore it may be more realistic to ask WTP to see what individuals will pay to have increased wildlife resources or increased access through a licence particularily if they were guaranteed more wildlife in the area.

Open-ended or closed-ended questions could be used. These questions could determine the WTP for a project to increase wildlife although this would involve work in developing and defining the project. WTP for a licence may be more definable and is a way of assigning property rights to a common property. People may be more willing to pay for this than for a communal project where they may expect problems with free-riding.

Open-ended questions were used in this field study to test response to WTP questions and response was mixed. While some people were not able to state a value, others could come up with a value that seemed rational. However, my questions were not really a test of the open-ended technique. The closed-ended bidding format may be more suitable in Zimbabwe because a good deal of trade occurs through bargaining similar to the bidding format. Therefore it seems reasonable to suggest that closed-ended questions, would be appropriate.

However, determining the range of possible values for closed-ended questions requires careful consideration of incomes and expenditure and then pretesting. The stated values range must be low and high enough to include the respondents possible total value. One comparison for this range of bids may be in relation to average meat expenditure. For use value it is not expected that the respondent would pay more to substitute wildlife then they would for meat expenditure. It is expected they would pay significantly less because wildlife meat is considered cheaper to buy than domestic meat. The household's monthly expenditure on meat may give a rough indication of what they may be WTP for increased wildlife to hunt in their area. Household income, may be a check on how realistic a bid is. An average income value could be used as a guideline for the upper limit. However, several households in the field study

indicated that non-use is also important. Therefore the range of bids needs to account for the non-use portion of the respondent's WTP which may be large.

An open-ended question may capture high bids which include a greater non-use value than was expected. However, whether an open-ended question at the end of the closed-ended questions would offer additional information or would instead be influenced by the bidding prices is unknown. It is suspected that the open-ended value could be biased towards the bidding prices, especially as the respondent may want to give the answer they feel is correct.

A possible format may be to introduce an open-ended question initially and then follow this by closed-ended questions. By introducing the open-ended question first then there would not be starting point bias from the suggested bids in the closed-ended section. The open-ended bids could then be compared to the closed-ended bids and the bids could be used as a check on each other.

The terms of payment require consideration. Monetary terms are usually used in developed countries however this may not be the most effective in developing countries. Although money is used in rural areas in Zimbabwe, monetary transactions may be less common among some households. Particularly households living close to subsistence level where cash income is very limited or very isolated households. Money value may be suitable for villages located near markets or with road access to market. Here the concept of money is likely to be strong. These households probably sell products in the markets or visit urban markets therefore their market exposure is great. However in more isolated or distant areas, people may not regularly visit large markets. Although trade may occur within informal local markets which may involve cash.

Non-monetary contributions may be more successful because some people may not be able to afford monetary contributions. Also, monetary contributions may be biased if people feel that the government should be paying. Promises were made during the liberation war in Zimbabwe, and now certain public goods are considered fundamental government responsibilities (Robinson, 1988). Wildlife resources are a public good with open access, therefore people may not be willing to pay for them. However, in the field study, respondents did appear to be WTP some amount. No one indicated that they felt that they were not responsible for paying or that the government should pay. Some households did, however, express some concern about ensuring that everybody paid.

Alternate forms of payment, such as trading, may be employed within rural areas. Therefore, payment in terms of maize or other crops may be a more recognizable form of payment. Main crops grown in the survey area should have a well-established value. Therefore payment in terms of crops could be easily converted to a money value. Contributions in terms of labour or materials may also be suitable.

Frequency of the payment should also be considered. This frequency should perhaps be the same as for some other billing or payment that might be received regularly by the household. Farmers would not receive monthly income but would be paid after harvest, so WTP bids could be very seasonal. However, individuals receiving remittances from spouses or relatives may receive these monthly. Instead of regular payments over time (monthly, bi-annually, annually) the payment for a project could also be a one-time payment for access. The seasonality of wildlife availability as well as income availability may be a consideration in determining the payment schedule.

Hypothetical bias could be a problem. While communal area households may have 'indigeneous technical knowledge' about trees and utilization (Campbell *et al*, 1993), they may be uninformed about externalities associated with that use (Campbell, 1993). Therefore tradeoffs in use may not account for these affects on other resources they use, such as their non-timber resources. Information and explanation may reduce bias due to lack of understanding or incorrect perceptions about the good being valued. However, hypothetical bias can still arise if the respondents do not take the CV questions seriously or do not anticipate having to pay. It seems reasonable to suspect that this type of hypothetical bias could be relevant. If the survey is not taken seriously then unrealistic responses may be given for amusement, particularly if other people are also present. Hypothetical bias was not examined in the field study. However, verification of responses might be to compare responses across the village or to consider the response compared to other expenditures and how much the wildlife is or would actually be utilized.

In this field study, interviews were conducted with respondents answering at the time of questioning instead of a possible approach where the respondent may be given a day to contemplate their answer. Allowing time to respond may be inportant for households to determine how they could allocate their income. However, the extra time may also introduce bias. Time would allow the respondent time to discuss the bid with family members and neighbours. Therefore they could collude to influence the actual bid. Also, the respondent may individually strategize especially if they see an opportunity to free ride. The best approach would probably be to receive the answers immediately and therefore avoid the possibility of this bias. The interviewer can allow sufficient time for the respondent to think about their response at the time of the question.

In conducting household interviews it was found that any available household members usually congregated as well as visiting neighbours. The presence of others, however did not appear to cause any hesitation in answers. Perhaps, privacy is not as sensitive an issue as it appears to be in developed countries where people as concerned with anonymity. In communal areas population densities are high and there is sharing of communal resources. As well, many tasks are done with others, such as collecting water, fuelwood or harvesting. Therefore the society may be more community orientated rather than individualistic. While the presence of people may not influence whether people respond, it may influence the actual answer. The respondent may not express his true WTP if he feels it sounds too low or too high compared to what others may say. Or perhaps the respondent may want to impress others or influence their bids also. While the presence of other people may influence responses, this situation may be difficult to avoid.

An alternative approach to WTP questions as discussed above, involves the referendum format. The referendum approach may in fact be more suitable, particularily if a specific value is not needed. Instead, the respondent votes on different scenarios with differing levels of wildlife quality or quantity. There could even be a price tag included with each scenario to determine monetary values. Votes for a particular scenario would indicate what the tradeoffs are in terms of wildlife and other resources. This approach may avoid some of the problems outlined above.

The field study found that community decision tended to be made by group consensus rather than voting although voting did occur. This reluctancy to vote against someone else may be a cultural trait (K. Muir-Leresche, pers. commn.). However, a referendum survey does not involve voting against someone else but is a choice for a particular scenario. The

referendum format also precludes determining an exact value for wildlife. If carefully designed the survey should allow wildlife to be ranked among other characteristics in the household's production function. It may be possible to value these other characteristics that are being traded off against different wildlife scenarios if the purpose is to derive wildlife values. However the ranking of wildlife within the household's production function may be sufficient to satisfy the purpose of valuing the wildlife.

Studies in other developing countries have supported use of CV. The background knowledge gathered from this study also suggests that CV could be possible. However, it would have to be closely tailored to the social and economic conditions of the research area. Conditions vary greatly across communal areas and within the communal areas and villages themselves. Therefore a blanket approach to CV is not applicable and some modifications are needed. It is not suitable for researchers to import CV studies done elsewhere without careful consideration of differences in the research area. More specifically, the researcher should have a familiarity with the area where they are attempting to employ CV or should employ assistants that are familiar with the area and with what the researcher is attempting to achieve. Also, pilot studies can be an important determinant of the success of a survey. Feedback from individuals in the villages may suggest which type of survey questions will work best. After revisions then a pre-test can be used to determine the final version of the survey. In general, the success of the valuation study will depend on the researchers understanding of the processes and conditions in the study area.

6.3.2 Hypothetical Variables To Consider With CV

The discussion above concluded that CV could be applied and highlighted factors that may affect the success of its application. This next section proceeds to suggest the variables that may influence the household's WTP (or WTA). These choices are based on variables suggested in other CV studies in developing countries as well as observations from the field study. The variables income, education, information and perceptions as well as household size were introduced in Chapter 3. These are considered as well as additional possibilities such as household employment, age, gender, environmental awareness, religion, ethnicity, drought and nearness to markets. Also, factors that influence household food security are expected to indirectly affect wildlife use, if household food security and the use of wildlife resources are related.

A positive relationship between income and WTP is generally expected. However with respect to small wildlife, WTP may decrease with increasing income if wildlife is considered an inferior good. Wild foods, including wildlife, offer a coping mechanism during food shortages and are considered more important to poorer households. Therefore as income increases, household food security increases so the dependence on wild food decreases and WTP may also decrease. Chimedza (unpubl.), however, found a positive relationship between income and the demand for wildlife. Therefore wealthier households may not use less wildlife than poorer households. The field study results also found a positive relationship between higher wealth households and wildlife use. In fact, use may be very low by lower wealth households.

However, it may be important to recognize the importance of cash income as being the determining factor. A significant portion of income in general may include non-cash income.

Therefore while a household may be wealthy in terms of total income, they may not have sufficient cash income to spare and this may influence their WTP.

In terms of non-use value, WTP may increase with income because non-use value may represent a luxury that can be afforded. Several higher wealth households in the field study did indicate the importance of wildlife for non-use value. However a few of the lower wealth households also mentioned this importance. Therefore it is not obvious if income would have a positive or negative relationship with wildlife value.

Outside employment of household members may be a factor. It is very common for communal area households to have an absent member who is employed elsewhere to support the family. This household member, who may be the household head, may only return occasionally throughout the year. Therefore if this is the male of the house then hunting of certain wildlife may not occur. However, households with no one to collect wildlife may be also be less WTP, even if they have the cash income, if they do not feel that they would benefit from increased wildlife resources.

Household size may be a variable for several reasons. Larger households would have greater demands on income and may be less able to contribute money, although they may be able to contribute labour. Mudimu *et al* (1990) found that larger households had lower per capita income. Therefore through income effects larger households may have a lower cash WTP bid. Alternatively, large households may also utilize and value wildlife more because they have more individuals to feed. However, Cutshall (1989) found that household size and compositions had very marginal effects on the value of wildlife (large) to the household, although smaller households were a little more inclined to view wildlife as valuable.

Education may have a positive affect on non-use values of wildlife if environmental awareness has been increased through school or exposure to literature and information. Alternatively, increased education may also decrease the respondent's use value for wildlife if they are exposed to more 'modern' society where these resources are less acceptable. However, education is not expected to be significant. In fact, older respondents may have greater use and non-use value through traditional and religious beliefs, however, these respondents would probably also have less education.

However, information and perceptions may influence responses. Cutshall (1989) found that the valuation of wildlife resources was likely to be affected by perceptions by the households of costs they would have to bear such as losses or damages from wildlife. Several households in the field study indicated that wildlife was destructive to crops and therefore they would prefer not to have it around. However, other households indicated that even though it may be a crop pest, small wildlife could easily be controlled and could proved benefits as well.

In terms of use value a positive relationship between age and WTP is expected. Older respondents may remember previous wildlife and may have previously hunted but now they see the wildlife depleted due to population and deforestation. With respect to use values they may wish to have wildlife to hunt again and therefore see it as important. However, Cutshall (1989; 1990) found in their socioeconomic surveys of communal households in Zimbabwe that as age increased individuals were more likely to see wildlife[15] as valueless.

[15]These studies mainly dealt with large game.

Younger generations may have less use value for wildlife. They may lack hunting skills to hunt and also may not have a taste preference for wildlife. However, with respect to non-use value, younger people may have increased awareness of environmental concerns through school. This awareness may increase their existence and option value for the wildlife. Parents may also have an interest in protecting wildlife for their children and therefore the wildlife would have bequest value. Several households did mention that they would like to have wildlife in the environment for their children to see.

Gender may also be a factor influencing WTP values. Different ages and genders are responsible for collecting different species of wildlife. Women tend to collect insects and some mice during harvesting. Children collect insects, mice and birds especially as snacks. Men may collect mice, birds and small game like hares, buck and wild pig. With some species there is also a difference between who collects and who consumes. While the majority of collection may be done by the women and children, the household male may have priority in eating. Also, mice collection may be practiced by children, however they may sell them to men as snacks. Therefore value may also differ between the collector and consumer. This study found that generally men tended to favor wildlife more than women. This was for existence value as well as use value. Women generally were less positive about wildlife. They were scared of large wildlife and felt it was dangerous and scared the children. Both genders were concerned about crop destruction.

Cutshall (1989; 1990) found gender differences in perceptions about wildlife also. Female-headed households tended to be more inclined than male-headed households to see no value in wildlife. Campbell *et al* (1994) found that

all their participatory groups (men, women, boys) highly ranked non-market values for woodland products. However, there were slightly different perspectives between the groups who each emphasized different non-market values. The men and women were more concerned with spiritual values and sacredness. In particular, the men were also more concerned with passing on the resources to their children. The boys stressed direct use values and ecological functions, probably due to environmental education at school.

Religion is also considered to be a factor in Zimbabwe. Zimbabwe is well-known for its traditional religious practices which are ecologically based (Nhira & Fortmann, 1991). Evidence of religious controls on resource use has emerged in studies (Bourdillon, 1979; Garbett, 1969; Gumbo *et al*, 1990; Matose, 1991; Mazambani, 1991; McGregor, 1989; Nhira & Fortmann, 1991; Wilson, 1987). Certain wildlife maybe considered sacred and therefore have great spiritual value. The household's religious beliefs may therefore influence their WTP.

Ethnicity may also influence WTP. Cutshall (1989; 1990; 1991) found that ethnicity did have a small effect on the perceived value of wildlife. Within a study area there may be different ethnic groups.

Access to markets such as a local business centre is considered relevant to the value of wildlife. Proximity to a market would determine the availability of substitutes for wildlife such as meat from the butcher. Increased nearness to a market may also mean increased urbanization and less available wildlife because of increased population density. Exposure to urbanization may also influence attitudes towards use of wildlife and taste preferences. A negative relationship between proximity to the market and use of wildlife was expected. However the field study results provided mixed evidence regarding the influence of markets.

In fact, wildlife utilization appeared to be more prevalent in some areas near markets while in some remote areas it was rarer.

Drought or crop failure may be a factor affecting consumption of wildlife through its effect on household food security. If crops fail or livestock dies then the household may be forced to rely on other sources of food. such as small wildlife. Chimedza (unpubl.) found that respondents felt that this was true. However, the drought could also result in a decline in wildlife numbers and therefore a decrease in use. Campbell *et al* (1994) found that drought affected producers and consumers of woodland products. Production of certain products such as mopane worms decreased. However, extraction of other products increased because financial pressure forced people to rely more on their local resources.

Resource richness in an area may also be a factor. Campbell *et al* (1994) found that an abundance of certain woodland products in one village resulted in a low ranking of those particular products even it they were essential products. People may not appreciate the resources because they take them for granted. Therefore people may be less WTP in areas where wildlife is abundant if little increase in wildlife resources is needed or the increase would be insignificant. However, if the wildlife resource is depleted and people do not feel that it can be restored then WTP will probably be low.

Household food security and use of wildife are expected to be related if wildlife is used as a coping mechanism during food shortages or is used more by poorer household. Therefore factors that affect household food security (income, agricultural production, seasonality, etc.) and agricultural success would indirectly influence WTP for

wildlife. However, some of these factors are already considered to directly influence wildlife value.

6.3.3 Methodological Issues

Various methodologies could be employed to carry out non-market valuation work and data collection. These could include formal and informal surveys, collection or dietary diaries, Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA). Most studies employ a formal survey to collect quantitative information for statistical work. However, informal surveys can also be useful for collecting qualitative and quantitative data. RRA and in particular PRA are also being used more for data collection and can play a role in economic valuation. A combination of different methods may be necessary to obtain the various components of the data collection.

Conventional methods to collect market data may utilize telephone or mail surveys as well as direct interview surveys. However due to the characteristics of the social market in developing countries direct personal interviews are often the only method of obtaining reliable information (Young & MacCormack, 1986). Social and cultural obstacles may still need to be overcome in order to conduct these interviews successfully.

Household interviews and surveys have been utilized in several household studies conducted in Zimbabwe (Chimedza, unpubl.; Chopra, 1989; Cutshall, 1989, 1990; Kinsey, 1986; Matiza *et al*, 1989; Murindagomo, 1988; Nhira & Fortmann, 1991; Sithole & Attwood, 1990; Stack & Chopak, 1990; Watson, 1994; Wilson, 1990). These studies have taken a variety of approaches. Cutshall conducted household interviews. Kinsey (1986) used a mix of administered structured questionnaires, formal panel and ad hoc discussion, direct anthropocentric measurement and observations. Matiza *et al*

(1989) administered a two-part structured questionnaire. Derman (1987) suggested that for household surveys, a combination of structured questionnaires and both open-ended and closed-ended interviews is best. Wilson (1990) conducted qualitative interviews backed up by direct observation and a recall survey.

Formal surveys may be expensive and slow in comparison to informal approaches. In fact, formal surveys may be unsuited to the nature of certain types of data. However, a combination of informal and qualitative methods can be combined with the formal and quantitative. This study supports the use of informal questioning supported by as much direct observation as possible. While in-depth studies are desirable, it may not be feasible to reside in a community for a long period of time. However, PRA may provide a useful way to get a quick overall picture. PRA could also allow community feedback into the actual design of the valuation exercise.

With surveys, there is the question of sampling. However, the choice of a sampling unit may not be straight forward[16]. Limited statistical information may prevent application of conventional methodology (Kaynak, 1978; Stanton *et al*, 1981). Young & MacCormac (1986) suggest that while constraints may prevent truly random sampling, it should still be possible to ensure that the sampling units reflect the social environment selected for the study. Bernstein (1979) even suggests that if the purpose of the study is to explore then non-random sampling may be adequate. However, scientific sampling is required if the sample is going to be described in order to generalize about the population.

Once the purpose of the survey has been determined, available sampling frames can be assessed to determine which

[16]Bernstein (1979) discusses sampling units, methods and sampling frames.

is the most appropriate. A number of sampling frames have been suggested by Bernstein (1979). These include lists from extension agents, although these lists may be biased towards only the households which the agent visits and who are therefore more well-informed. Information can also be obtained from the Ward Counsellor or District Administrator such as census, voter and farmer lists. However these may be outdated or exclude certain people such as women. There is also the possibility that lists are inflated. Food distribution lists are based on the number of households in an area therefore the list may overstate the actual number of households.

The Agritex worker should be a useful source of information for the area. They should have information at the ward and household level although perhaps not by village. However, because this information is aggregated from a village level census conducted by the regional Agritex, village level information should also be available.

If using census data it must be realized that it may be outdated, incomplete or inconsistent. A national census was carried out in Zimbabwe in 1992. However government statistics and numbers reported in different sources seem to differ. It is suspected that populations in rural areas may be underestimated therefore caution should be used in relying on the census for accurate sample sizes for an area.

Due to the unreliability of existing population lists for the area, Watson (1994) found it necessary to conduct a mini-census in order to verify the number of households and population in her study area. However, Waeterloos & Guveyo (1993) based their sample on a membership list for a grazing scheme. They also suggested use of membership lists from the secretary of a scheme, or lists from local extension workers or the village kraalhead.

Instead of sampling based on a list, another possible sampling method involves choosing random households from air photos. Grids are drawn on the photos and then random selections made from clusters of households (Derman, 1987). In this way, clusters could be chosen that may have certain features that the researcher specificly wants included in the sample.

Selecting a sampling frame is a compromise so the researcher must be aware of the biases. However, a sampling frame is also cheaper and less time-consuming than conducting a census in the area (Bernstein, 1979). Sampling using air photos could also be expensive unless they are already available.

Next, is consideration of the sampling unit. While a village may seem like an informative unit, Cutshall (1989, 1990) found that the demarcation of villages in Zimababwe was a historical artifact of the earlier colonial government. In fact the village was not a discrete area and households that may be claimed as part of a village may not be within or adjacent to that village. Therefore they felt that sampling by village would not yield homogeneous groupings.

Wilson (1990) chose cooperative household clusters as his sample unit. He felt that these cooperative households captured the units of social and economic orgainization as well as domestic management. Because these units were socially inclusive (ie. they include rich and poor, male and female, young and old), even non-random sampling was not expected to cause much bias. Therefore clusters were selected from different areas to try to be representative. A few individual households were also included.

Matiza *et al* (1989), however randomly selected villages within their survey areas and interviewed all the households

within those villages. Nhira and Fortmann (1991) used purposive sampling of field sites to include all natural regions. Within villages, their sample of households included a variety of conditions. Kinsey (1986) used random and purposive sampling. In one area, half of the villages were selected at random and all households were attempted to be interviewed. However only half of the villages selected got full coverage. Some additional villages were added at random. In the other area, a random sample was chosen, based on the resettlement officer's list of resident households per village.

Waeterloos & Guveyo (1993) based their stratified simple random sample on a membership list for a grazing scheme. Watson (1994) used systematic sampling. An intitial household was randomly chosen from the mini-census list. Then every fourth household was selected for an interview. However later, purposive and quantitative sampling[17] was determined to be more appropriate to get an equal number of male and female household heads.

Choice of interviewees must also suit the purpose of the study. Derman (1987) suggests randomly selecting interviewees within the household and also including children. Cutshall (1989) only interviewed household heads or their representatives, Kinsey (1986) interviewed an adult from the household, Watson (1994) interviewed all available household adults, while Matiza *et al* (1989) and Nhira and Fortmann (1991) interviewed household heads and their spouses. Wilson (1990) on the other hand addressed his questions to whomever was most suited to answer.

Finally, key to the data collection or survey success are the interviewers. In the communal areas, English is not

[17]However with purposive sampling, sampling errors and biases can not be determined because the assumptions of statistical testing can not be met. Therefore the results of statistical testing on the data should be interpreted with caution.

generally spoken. Therefore the interviewer must be fluent in the indigeneous language for that area. In Northern Zimbabwe, the language is generally Shona, while in Southern Zimbabwe it is Ndebele. However, there are dialects within these languages. Therefore it may be suitable to have interviewers from the area. Also, if the interviewers are familiar with the area then they can help adapt the research design to suit the area. However, education level would be important so that the purpose of the research is well understood by the interviewer.

Other factors to consider may be effects on the responses by the respondent if they know the interviewer. The respondent may not take the questions seriously, or may not want to disclose information to the interviewer because of lack of privacy or ill-feeling toward the interviewer. Alternatively, the household may also be more willing to share information with someone they know while an external interviewer might be viewed with suspicion. It is important to establish credibility and to dispell suspicion so that the research is taken seriously. Therefore an interviewer from the area would probably be most suitable in order to get a more complete picture.

The next main step in the research would be data collection. In research there is often the concern that something may be missed, however there is also the possibility that some information just may not be obtainable. It is useful to anticipate what information may have to be neglected or will require more work. Developing proxies for different indicators may substitute for intensive time-consuming data collection. Cousins *et al* (1988) suggest that concepts identified in anthropological work could be used as indicators in formal surveys. The collection of the following data are discussed to suggest which are obtainable and which may be potentially difficult to collect.

Collecting information on income in the communal and resettlement areas of Zimbabwe could be difficult. However, household studies on food security (Chopak, 1989; Chopak & Stack, 1990; Mudimu *et al*, 1990; Sithole & Attwood, 1990) have been able collect data on household income and sources. They were able to determine the annual net household income as a sum of a cash-equivalent of production for home consumption (crops, livestock, non-agricultural products), cash from income generating activities (sale of agricultural and non-agricultural products, labour), and cash equivalents of transfers (remittances, gifts, drought relief, etc.) less the costs of acquiring the above sources of income. Socioeconomic studies by Cutshall (1989) also were able to get household income data.

Indirect methods may also be suitable. While electrical appliances as a measure of income, as in Briscoe *et al* (1990), is hardly relevant to households in communal and resettlement areas, the same idea of accumulated assets can be applied. As with Zimbabwean studies by Campbell *et al* (1989), Watson (1994)[18], Whittington *et al* (1990; 1992)[19] and Wilson (1990), observations about the holdings of the household can be used to infer wealth. Kinsey (1986) used an index of material well-being in his socioeconomic study. Observations about the household may include the quality, construction material (sheeting vs. thatch[20]; brick vs. mud and stick; wooden frames and glass vs. none) and number of buildings. As well, presence and quality of toilet and water facilities, farming implements and tools (buckets, hoes, chemical sprayers, plough, cultivator, harrow)[21], trailers (Scotch cart) and vehicles, household items and

[18]Watson (1994) used farm implements as a wealth proxy.

[19]Whittington (1990; 1992) developed an index based on the nature of housing, domestic water supply and sanitation facilities, cooking and lighting fuel, home furnishings, farm equipment and transportation.

[20]Wilson (1990) found that iron and asbestos sheeting was more common in wealthy households.

[21]Wilson (1990) also found that the wealthy, as would be expected would have more agricultural equipment.

other assets. However, land access does not appear to be an indicator (Watson, 1994; Wilson, 1990).

Another indicator is the level of remittances from outside. Those households receiving outside income tend to be better off[22]. However, Cutshall (1989) felt that it would be very difficult to measure the cash injected into household economies from outside because the calculation and guesswork required would not even guarantee that the full and accurate amount was disclosed. Also a precise measurement time would be needed. They found that there were few observable signs in households with extra income although they may be more likely to be growing a cash crop because they can afford the inputs. However, they suggested that the best predictor of extra income was the annual status of household residents. Those households with part-time residents and newer households were more likely to receive extra income.

An important wealth indicator is livestock, such as cattle, goats and sheep. These act as a cash reserve to be drawn on during times of need (Stack & Chopak, 1990; Cousins *et al*, 1988; Zindi & Stack, 1991). Cattle, in particular, are a sign of wealth. They represent insurance in times of need and are often used as payment in lobola. Cattle's contribution to household income (cash and non-cash) is substantial (Jackson & Collier, 1991). This ownership, however, may be hightly skewed between the rich and the poor (Wilson, 1990). Zindi & Stack (1991) found that the highest wealth quartile had the highest percentage of people with cattle and small livestock, while the lowest quartile had the highest percentage of people with either no livestock or only small livestock.

Household composition and size may also reflect wealth. The number of wives a man has may indicate wealth assuming that

[22]Although perhaps these households are worse off and require this outside help.

the wealthier a man is the more wives he can afford. In many African societies, labour is constrained. However, as households have more members they become richer. Wealthy households tend to have more members because wealthy men can afford to increase their household size through marriage to additional wives. Also, children may join wealthier households and supply labour in exchange for school fees.

An alternative to basing wealth groupings of households on observations which may be misleading, is to use wealth ranking exercises. Ranking exercises can be done through PRA as done by Campbell *et al* (1991) and Wilson (1990). The ranking attempts to place households into homogeneous groups which can be distinguished from each other by selected characteristics. In these exercises, community members assign ranks to people within their own community. Characteristics that differentiate the different wealth groups may include remittances, other sources of income, agricultural success with widows, the elderly and others without support being placed in a low ranking[23]. However, several problems may make this type of ranking inappropriate or incorrect for analysing certain causal relationships (Wilson, 1990).

Gathering information on expenditure accounts may be difficult. Recalling weekly expenditure may take some encouraging. However expenditure should be recordable because it would probably be relatively minimal and would consist of certain basic goods which are regularly purchased. Information on basic goods could be extrapolated to monthly and annual expenditure. However, seasonal affects on expenditure, especially with wildlife, must be considered as these may be considerable. Several household studies (Chopak, 1989; Chopak & Stack, 1990; Mudimu *et al*,

[23]Examples of wealth groups are found in Campbell *et al* (1991), p. 34.

1990) have been able collect data expenditure on different categories of goods.

Household composition may also prove to be rather ambiguous. Extended family linkages and absent members may cause some confusion as to the actual household composition. Defining the household in the field study was not always entirely clear. The number of people stated for the household often did not match when specifically asked for a breakdown of the family members into mother, father, sons and daughters, their spouses and children. However, after some discussion among household members and clarification by the researcher the household could usually be identified. With careful tracing of the relationships the researcher should be able to determine the household composition that coincides with the researcher's definition.

In Zimbabwe, determining exact ages may not always be possible. Cutshall (1989) found that 'the collection of precisely accurate age data in rural and largely illiterate communities was a problematic task at best'. Nhira (1989) and Watson (1994) also encountered problems collecting age data on household residents. Relating an individual's birth to an associated event, as well as using information about marriages and births of other family members, may be also be good methods to determine the approximate date of birth. Cutshall (1989) based age estimates upon informed guesses or estimates by the survey enumerators. He felt that the ages reported for younger respondents were probably quite precise but were probably inaccurate in most cases for older repondents. Watson (1994) used age categories to reduce anxiety. Wilson (1990) obtained age as accurately as possible for those under 20 years old and grouped the remaining population into decadenal age categories.

In Zimbabwe, a date of birth is required on each individual's national identity card however this may not

necessarily be accurate. Nevertheless, using the date of birth on the national identity card may be accurate enough for research purposes. The extra time invested in trying to get a more accurate age may not be worthwhile.

Accurate agricultural information (acreage, quantities) may not always be easy to obtain. Quantities of crops marketed should be possible, especially if the farmer markets his produce through the Grain Marketing Board or the Cotton Marketing Board. Grain is measured in sacks prior to storage however the size of the sack may vary[24]. In good rainfall years, farmers typically publicly count out their sacks of grain therefore overall yields are well known (Wilson, 1990). During low rainfall years, however, harvesting is done piecemeal from the field and not measured all together. People also do not want to discuss poor yields. Wilson (1990) did find that women gave better data than men in poor years compared to good years.

Acreage estimates are also questionable. While some farmers may know their acreage, most of the smaller farmers probably will not have a concept of acreage or hectares of land. This is likely among communal area households which may be largely illiterate and innumerate (Cutshall, 1989; 1990). Watson (1994) found that while some people were confident about their estimates, others were unsure. However, there were also wide divergences in estimates within households and even by the land owner for different pieces of similar sized land. Acreage estimates may have to be determined by the researcher based on their own observations or measurements. Reliable acreage figures may be difficult without aerial photos or physical inspection. However, these methods are costly, time-consuming and are only a marginal improvement over informed quessing (Cutshall,

[24]Wilson (1990) found that while the offical sack contained five buckets of grain or 90 kg, the local sack was larger.

1989). Wilson (1990) used physical inspection as well as tracing boundaries with aerial photos. Cultivation methods though may serve as an indicator. Cutshall (1989) found that hand-cultivated plots (about 3.99 acres) were around two acres smaller than those cultivated mechanically or by draught (about 6.2 acres). Therefore cultivation methods could be used to determine a general grouping of land sizes.

It may also be difficult to determine livestock holdings. People may be reluctant to reveal full amounts. There could be further complications due to the complexity of ownership relations and terms (Scoones & Wilson, 1988). However, the researcher must also be aware that there is a difference between livestock ownership and holding (Scoones & Wilson, 1988). While ownership entitles an individual to the final authority and proceeds of sale of the animal, a holding only allows an individual year round access to the use of the livestock. Kundhlande & Mutandi (1989) found that 3 % of the herds in their area were held not owned. Also, ownership of livestock may involve different members of the household (Scoones & Wilson, 1988)

A study on the use of wildlife may entail studying overall food intakes to get a perspective on the significance of the wildlife in the diet. However, Wilson (1990) found that obtaining quantitative information on actual intakes was difficult. He even found that it was hard to make general estimates of the importance of specific foods. It is hard for people to recall over the year. He decided to determine what properties of households stated that they had consumed a particular food within the last year. Consumption was therefore measured in terms of the number of days in the season that people in the household consumed the particular food. However, this data does not indicate what quantity is actually consumed. Wilson (1990) also suspected under-

recording of wild foods. Certain foods may be considered shameful and therefore eaten in private.

Questions about education and occupation should be possible. People should know how many years they went to school Although maybe some will not want to admit if they have little education. Watson (1994) and Cutshall (1989; 1990) were both able to collect this infomation. Occupation information however will probably be with regards to absent household members who are working elsewhere, so detailed information may not be possible.

The next methodological issue, after data collection, involves treatment of study results. Data from one research area can not necessarily be extrapolated to Zimbabwe as a whole. Bradley (1990) found large differences in rates of woodland dependency which suggests that woodlands have to be valued quite differently from area to area. Wilson (1990) also found large differences in the abundance and use of wildlife in different ecological areas. As well, household studies in Zimbabwe found that consumption of woodland products varied between households (Campbell *et al*, 1991; Grundy *et al*, 1993; McGregor, 1991). The field study results also found a great deal of variation between different villages as well as between the two study areas. Therefore, to generalize based on a study would be inaccurate. Bojo (1993) suggests that the broader the group the more difficult it is to obtain a valuation. However, focusing on a household level and differentiation between households may be more relevant to examining tradeoffs between woodland management and other household resource allocation strategies (Dewees, 1992).

The challenge with doing a study is in trying to contextualize it within its wider regional or national environment (Devereux & Hoddinott, 1993). If a population is homogeneous then a few observations can be used to

generalize to the entire population (Casley & Lury, 1987). However, this study did discover that this is not the case therefore sweeping generalizations can not be inferred from the data. It would be inaccurate to generalize on the incidence of a phenomenon or average value of a variable within a larger population based on these field studies. In fact, the study served to demonstrate that there is a lot of variability within the country at a local as well as an individual level. Therefore any further studies should also recognize that the results would not necessarily be consistent with the situation elsewhere. However, individual studies are useful in that they may enable one to reject existing generalizations regarding wildlife use and values and to develop a range of values.

6.3.4 Summary

CV should be possible to apply to resources, such as small wildlife in communal areas. However factors may limit its success such as income constraints which may render WTP as zero while WTA may be large. Also, cultural traits may influence accuracy of responses. Discussion of variables that may influence WTP values for small wildlife, and possibly other resources as well, suggested income, household size, education, information and perception, age, gender, religion, ethnicity, market access and environmental conditions such as resource availibility or drought effects, as well as factors influencing household food security. Discussion of methodological approaches included survey and data collection approaches as well as potential problems and alternatives. This comprehensive examination of CV should provide a framework for future researchers to design their valuation study.

7.0 DISCUSSION AND IMPLICATIONS

7.1 SUMMARY

Zimbabwe, while faced with a rich endowment of resources also faces resource utilization problems in communal areas. Deforestation in communal areas is a rising concern, particularly because households in these areas rely heavily on trees for a multitude of non-timber as well as timber goods and services. Recognition of the value of non-timber resources has highlighted the lack of information about these resources in communal areas. One such non-timber resource is small wildlife which has generally been excluded from household studies. The importance of small wildlife is hypothesized to be great yet little is known about the household's actual use and value of this resources. Recognition of this importance necessitates valuation of this resource so that its value can be incorporated into resource management.

This study provides a better understanding of the communal area household's use of wildlife and suggests suitable valuation techniques that can be applied to small wildlife resources in communal area. Extensive literature review substantiated by field studies was used to develop a descriptive background for any subsequent valuation studies. The field studies consisted of a main household study conducted in Chinamura communal area supplemented by a study in Nyanga district. Descriptive and quantitative data were gathered to determine the importance of wildlife.

The results of the field studies found that nearly every household utilized small wildlife to some degree. The quantity and variety of wildlife utilized varied between households as well as between areas. The collection of

small wildlife generally tended to be opportunistic and occurred while conducting other tasks such as harvesting or herding cattle. However, certain species which were very seasonal might necessitate specific time allocation. In general, very little equipment or expense was involved in collection. Small wildlife was often used as a snack or an extra to provide variety to the main relish. However, if collected in bulk it could be used as a main relish, preserved, or marketed. The extent of wildlife utilization by households was influenced by factors such as wealth, remoteness, tastes, labour availability, religious beliefs and social controls, as well as seasonality and small wildlife availability. In general, people felt that small wildlife resources had decreased in their areas. They attributed this decline to increasing human population which forced the wildlife to migrate to other areas such as state forests and commercial farms. While some households saw small wildlife as an agricultural pest, several households expressed an interest in increasing wildlife in the area. They felt it was important in terms of diet and income or even to have in the environment for existence and spiritual reasons.

This field data as well evidence from other studies supports the widespread use and importance of small wildlife throughout Zimbabwe. However, the extent of this utilization throughout the country varies considerably. This variation is a consideration in conducting valuation exercises. Different species and small wildlife in general will have different values in different areas. Therefore study results and values may be quite site specific.

In order to address the question of valuation, several methods of valuation were examined. The Household Production Function provided the contextual framework to consider several valuation methods. However methodological

limitations in communal areas may restrict the applicability of these methods.

The derived demand approach requires detailed information on the flow of the small wildlife to households. This information may be difficult to acquire because much of the wildlife collection is occasional and opportunistic. However, it should be possible. Measurable costs of wildlife collection may be negligible in terms of time and equipment. Even if collection time can be determined such as specific collection trips, assigning a labour rate may not be suitable. Another serious limitation arises because much of small wildlife use is for household consumption and involves no marketing. Therefore this method would understate the value of the small wildlife to the household.

Other approaches may be possible but again these face limitations. The value of "replacement products" presents a link to market prices but this method should be considered with caution with respect to small wildlife. Because small wildlife is often used as a snack or extra no substitution may occur therefore a replacement product should not be assigned. Also, communal households may view small wildlife as a cheaper meat because it is free in the surroundings therefore domestic meat prices would not reflect what the household would actually pay.

Alternative approaches involve proxying demand for small wildlife as a function of frequency of consumption. This consumption could be compared to total food consumption and expenditure, although much of the food is obtained through household production as well as through expenditure. Alternatively, frequency of collection could be used as a proxy. This frequency could be related to time spent on other tasks and perhaps related to food expenditure or wage rate, although again time allocation may be difficult to specify. A final limitation of the Household Production

Function valuation methods is that they cannot be used to measure non-use values therefore they will understate total value of small wildlife resources. Thus these approaches yield only limited values for small wildlife resources.

Ranking may provide a useful method for determining the importance of small wildlife and possibly inferring a value. Small wildlife could be ranked among other goods utilized by households to determine its relative importance. If these goods have market prices then some idea of value may be inferred. Alternatively, resource areas with varying levels of resources including small wildlife could be compared to determine the importance of small wildlife with respect to other resource tradeoffs. Ranking may not provide a monetary value, however it may provide a more suitable representation of value that could still be reflected in resource management decisions.

A more specific examination of non-market methods found that Travel Cost Modeling and Hedonic Price Modeling, two methods of Household Production Function valuation, were not considered suitable. Travel Cost Modeling was limited because of the nature of small wildlife collection. This collection is often occasional and opportunistic. Much collection occurs in conjunction with other tasks therefore the time spent would be difficult to determine. Even if time can be determined, such as with a specific trip, it would be difficult to determine an appropriate wage rate. Also, equipment and collection costs would be minimal. Therefore there would not be any suitable measurable factors for this approach.

Hedonic Price Modeling is also inappropriate due to the lack of property rights. Traditional land allocation precludes sale of property. However Hedonic Price Modeling requires land prices to derive values for environmental qualities.

While these indirect methods are inappropriate, a direct approach, Contingent Valuation, appears potentially useful. CV can be used to estimate non-use as well as use values. Application of Contingent Valuation though, requires consideration of several factors. These include choice of WTP and WTA questions and the method of payment especially with respect to limited cash incomes. The accuracy of responses may be affected by cultural traits. The importance of giving an accurate answer may not be recognized and the respondent may want to give an "interesting" response especially with others around. The respondent may give the answer they feel the interviewer wants to hear or they may answer strategically.

A variant of Contingent Valuation, the referendum approach, may be more suitable. By voting on different scenarios with varying levels of small wildlife and possibly a price tag attached to each scenario, different tradeoffs and value can be determined. This approach may avoid some of the above problems.

Evidence supports the importance of wildlife. However valuation is needed so that this importance can be incorporated into resource management decisions. The discussion of valuation approaches and methodological concerns through this study should provide a framework for further valuation work. However, application of any valuation method will require an understanding of the household and cultural factors involved.

7.2 CONCLUSIONS AND IMPLICATIONS

The main question that arises out of this study is why do we need to value small wildlife. One intent of this study was to determine if small wildlife was worth valuing. If it did not represent any great value to the household then there would not be any reason to pursue valuation of this resource. However, the field results suggest that while quantities used may seem small, these resources still remain significant because they appear to be used by the majority of households to some extent. Therefore small wildlife resources play a role in household processes. Also, the field studies were not intensive, therefore while providing a broad picture they do not necessarily reflect the true extent of the use of small wildlife resources. It is possible that use may be more significant than is apparent currently.

If small wildlife is indeed important then these values need to be incorporated into resource management decisions at the government level or the community level. Government projects such as irrigation, boreholes, rural extension, afforestation and habitat improvement require Benefit Cost Analysis to determine their feasibility. Benefit Cost Analysis requires values to assess tradeoffs. However, inadequate values for particular resources such as small wildlife often means that these resources are excluded from the analysis. As a result, projects or policies may not accurately reflect actual tradeoffs.

Recognition of small wildlife values may also help to expand government policy which may not be meeting the goals of household in the communal areas. Policy may need to change to better support the communal way of life. Changes could be directed at reducing barriers to resource access. Removal of hunting restrictions on small game and possibly large game as well as allowing some form of controlled

access to state forests could expand communal households' potential resource use which may improve household well-being. As well, government support could be given to community projects which enhance habitat for wildlife.

Community management of resources, however, may replace or supplement government management. Small wildlife values may be significant in their role in community management. It is possible that through identification of values, property rights may start to develop. Contingent Valuation, could be used to identify individual values. Making these values explicit to communities and allowing them to recognize and discuss these values may lead to better management of resources. The result may be better management of habitat for wildlife which in return results in increased wildlife for households. While there is the threat with communal property that overexploitation may occur, there may be a strong enough recognition that restraint increases the benefits for everyone. However, if households do not realize the value of wildlife or if tastes have already turned away from small wildlife use then it may be hard to promote small wildlife conservation unless significant values can be demonstrated.

The value of small wildlife could be important also in terms of market values. These values may determine that marketing of small wildlife is a viable supplement or even alternative to household agricultural production. Prices are already well-established for some wildlife in certain areas where informal and formal markets are already operating. Informal markets exist within villages between neighbours. Some households also sell to formal markets in local business centres, townships or cities. A barrier to increased marketing of wildlife, though, may be the amount of wildlife in the area. However, through community management it may be possible to enhance small wildlife resources. As well,

formal or informal markets may emerge where they were absent before, therefore opening new opportunities.

There is, however, the possibility that increased marketing could increase the gap between high and low incomes. Households with transport and market access may exploit small wildlife resources to market while households that do not market but use small wildlife for household consumption may suffer. However, community control and group incentives to conserve habitat and small wildlife resources may reduce exploitation. Through community action it may also be possible to overcome other marketing barriers, such as transportation to distant markets. Removing barriers may allow more households to participate in marketing and improve overall community welfare. Government may play a role in reducing some of this market barriers.

While wildlife utilization patterns have changed over time due to historical and social factors, emerging factors may also influence use in the future. Household sizes and compositions may change due to increased employment off-farm and other factors. As a result, household production and consumption patterns may change to reflect the loss of labour and/or income. Use of small wildlife may decrease because there is no one available to collect it. Alternatively, households may become more dependent on environmental resources if their agricultural production or income decreases.

Environmental conditions such as changing weather patterns and frequent occurrences of droughts in communal areas may force households to look for alternatives to agriculture for food and income. The use of other environmental resources such as small wildlife may be more sustainable. In particular, small wildlife species that are little affected by drought may become more widely used.

Finally, political and social change could also lead to change in communal area lives. Household patterns and tastes may change and as a result, small wildlife use could change. Also, community cohesion and traditional controls may be breaking down. This breakdown could affect community control of resources and the potential success of community management projects discussed above. Alternatively, resettlement may ease resource pressures and allow increased utilization of resources. However, further population pressure on already strained resources may exacerbate resource degradation and depletion. As a result, resources such as small wildlife may become more necessary to meet household food requirements.

7.3 RECOMMENDATIONS FOR FURTHER RESEARCH

The results of the research suggest potential areas where further research is needed. The nature of this overall study was to provide a broad background and investigation into the importance of small wildlife and its valuation. The analysis considered several issues and suggests a framework for empirical research. As a result, this study serves as a stepping stone for more specific and applied research on the aspects suggested in the model.

First, as discussed at the beginning of the study, very little research has been done on the importance and use of small wildlife by communal area households. Of particular importance is the role these resources play in the household economy or the extent of dependence of the household on these resources. This study attempted a broad investigation. However, specific studies need to be conducted in various regions in order to better determine the importance of these products and more specifically to

which households. This value could vary greatly between areas and can not necessarily be extrapolated to Zimbabwe as a whole.

In general, studies of small wildlife are needed at a household level. These studies need to look at the impacts of small wildlife use at the household level and on decision making. Little is known about the role of woodland resources in household allocative processes involving labour use, land use, income and expenditure. The relationship of these resources to household food security and risk-spreading is also poorly understood.

Studies also need to consider the impacts of small wildlife use across groups of households as well as within the household. In particular, studies should identify not just how many households are dependent on small wildlife resources, but which households and the characteristics of these households. This information could then be used to determine how access to these resources can be improved especially during times when they are needed.

In conjunction with looking at household use, overall communal use of resources should be assessed. Resource access and control issues need investigation as these influence the household's freedom to use these resources. Insight may be gained by examining changes in traditional and institutional controls over time and the effects on resource use and value as a result of these changes. It may also be important to look at temporal and spatial changes in wildlife use. Perhaps, instead of just focusing on present wildlife use, it may be useful to compare past use and factors influencing change over time. Information is needed to determine how wildlife values change in time and space as a result of variables such as the season or year, environment and individual variables such as gender, wealth and age. Also, spatial distribution of the human

population compared to the wildlife population and how this has changed over time may be important. In reality it may not be possible to increase wildlife numbers due to population pressure and irreversible change in habitat. Therefore the costs of restoring or conserving wildlife should be investigated.

Small wildlife as well may have potential market value that is not being utilized. There has not been any research into the market demand for these products and factors influencing this demand. It is suspected that any feasible opportunities to market the wildlife would be capitalized on by resourceful individuals. Therefore, lack of marketing may be due to costs. The barriers to marketing these resources should be investigated. These barriers may include lack of transportation, lack of a market or market information, seasonality in wildlife supply or perhaps a lack of supply of wildlife. Investigation into marketing may discover a potential value for small wildlife that could be developed if present barriers could be removed or lessened.

Also, the importance of small wildlife products may not be only in their individual value per se but in their contribution to the overall value of forests. Information on small wildlife values could be gathered as part of larger studies looking at non-timber valuation. In particular, it is recommended that these resources are studied along with all wild foods that are gained from the forest.

Valuation of natural resources is a very new area of investigation in Zimbabwe. The application of ideas and methodologies need to be adapted and explored with Zimbabwean resource issues. This study suggested possible methodologies and potential problems were highlighted. However, these methodologies need to be applied so that problems can be examined in actual studies. Also, several

potential variables have been suggested which may be significant in CV studies. These variables, however, have not been empirically tested. It is important to determine which variables are significant and should be considered in policy decisions. Further empirical studies can serve to contribute to valuation research and in general as well as to wildlife valuation. While this study focused on valuation methods for small wildlife products, the proposed framework could be applied to other non-market resources as well.

Further research should have clear policy links. The research should be designed to focus on issues that are relevant to policy decisions and not just to fulfill a research interest. In developing countries, research resources are limited and should be directed to areas where the research is most needed. Therefore research should provide information to guide policy decisions in the use of resources and social welfare.

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APPENDIX A

SUPPLEMENT TO PROFILE OF ZIMBABWE

Physical Description

Zimbabwe, located in South-central Africa is divided into three main altitudinal regions. (Map B.1). Rising up from 1 200 metres above sea level is a high plateau, the Highveld. Encompassing 20 % of the land, the Highveld dissects the median of Zimbabwe. This gently undulating plateau, which dominates the country's physical features, contains Zimbabwe's most fertile land. The vegetation is mostly savanna woodland with well-spaced trees over the wide expanses of grassland. From this plateau two watersheds serve water courses running northwest to the Zambezi river and southeast to the Limpopo and Save rivers.

To each side of the Highveld lies the Middleveld at 900 to 1 200 metres above sea level. The landscape is undulating to rolling with common rock outcrops. This transitional area of variable vegetation, covers 40% of the country. However, the land in the Middleveld is less fertile than the Highveld.

The remaining land below 600 metres is termed the Lowveld. This area is hotter and drier than the Highveld resulting in unsuitable conditions for agriculture. Landscape is generally fairly flat. Here, vegetation mainly consists of dry savana woodland and scrub.

Other significant regions which are within the above velds are the Eastern Highlands, the Kalahari sandveld, Zambezi valley and the Middle Save valley. The Eastern Highlands is comprised of a series of mountain ranges. These extend some 250 km along the Mozambique border. The Kalahari sandveld covers an extensive area in Western Zimbabwe. This flat to gently undulating land is influenced by a mantle of Kalahari sand. A transitional areas bridges the plateau in the east with the sand plain and pans in the west. The Zambezi valley consists of two subregions separated by Kariba gorge. The broken terrain of the upper region consists of many low ridges and hills. While the lower region along the Mozambique border is less broken and becomes flat to undulating. The Middle Save valley is a broad pediplain which is generally flat to gently undulating.

Zimbabwe is covered by five main vegetation types[1]. These include: Afromontane forest and grassland which occur in parts of the eastern highlands; Zambezian miombo woodland in the highveld and middleveld; Mopane woodland and scrubland throughout the lowveld; Acacia scrubland in the southwest; and dry forest and scrubland which is found on the Kalahari sands in the west. This categorization by Bradley & Dewees (1993) is based on a combination of studies (Millington & Townshend, 1989; Rattray & Wild, 1961; Speece, 1982).

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[1]See Table C.2 for scientific names of tree species mentioned.

Miombo woodland is dominated by *Brachystegia spiciformis* along with *Julbernadia globiflora*. These woodlands dominate the highveld above 1 200 m with high rainfall and generally sandy soil. There are variations in the *Brachystegia* species and subsidiary species that are present depending on soil factors. Undisturbed, this woodland is characterized by a single statum of 6 - 12 m in height which forms a canopy cover of up to 80%.

Mopane woodland occurs in the hotter, drier regions below 900 m. It is best suited to deep, well-drained soils and can develop on more clay-rich substrates. Monospecific stands of *Colophospermum mopane* are quite common but other species may also occur, although not with as much diversity as found in the miombo woodland. A closed canopy with little understorey is common although more open canopies may form with some scattered shrubs underneath. Canopies may range from 10-15 m.

Teak woodlands are found growing slowly on the Kalahari sandstone formations in the west. Here the deep sand is infertile and rainfall is low. These woodlands are characterized by *Baikaea plurijuga* in association with *Pterocarpus angolensis* and *Guibourtia coleosperma* along with *Terminalia* and *Combretum* species. In marginal areas the teak woodlands may grade into the miombo woodlands.

Acacia woodland and savannas are extensive throughout Zimbabwe, occupying specific areas. Different species of *Acacia* are associated with different soils derived from geological formations. *Acacia giraffae* is dominant in the Kalahari associations, *A. nilotica* on black clays, *A gerrardii* on basement schists, *A. tortilis* on the colluvial sands of the Zambezi valley and *A. nigrescens* on the Permian sands of the Save valley. Canopy height may reach 9 m with varying trees density. In lower rainfall areas, more open savanna occurs.

Terminalia - Combretum woodland is a tree and shrub combination. The characteristic species are *Terminalia sericea* and *Burkea africana*. Other trees and shrubs such as spp. are found in association.

Geologically, Zimbabwe has two distinct zones. The sedimentary rocks of the Karroo system in the southeast also cover the Zambezi valley and a vast area south of Lake Kariba. In the extreme northwest and southeast jurassic lavas are exposed. Kalahari sands cover the northwest. The Gold Belts and the Great Dyke are also notable in that they provide the country's main minerals.

Zimbabwe is divided into five main agroecological regions with agricultural potential declining from Region I to Region V. (Map B.2)

TABLE A.1. Land Distribution by Agro-Ecological Regions

Natural Region	Land Area (million ha)	Percentage of Total
I	0.62	1.6
II	7.31	18.8
III	6.85	17.6
IV	12.84	33.0
V	11.28	29.0

Source: Government of Zimbabwe, 1989.

Natural Region I, includes 0.62 million ha or 1.6 % of the land. This area has very annual high rainfall (>900 mm above 1 700m altitude and > 1 000 mm below 1 700 mm) and normally has some precipitation throughout the year. Temperatures are relatively low. The area is suitable for specialized and diversified farming such as dairying, forestry, tea, coffee, fruits, maize, etc.

Natural Region II, with 7.31 million ha and 18.8 % of the land, is an intensive farming region. Rainfall is moderately high (750- 1 000 mm) and occurs only in the summer. Subregion IIa has reliable rainfall and rarely experiences dry spells in the summer. Subregion IIb may experience shorter rainy seasons or dry spells during the rainy season which may affect crop yields in some years. Natural Region II is suitable for rainfed agricultural crops

such as maize, tobacco, cotton as well as for beef production.

Natural Region III contains 6.85 million ha or 17.6 % of the land. Rainfall is moderate (650-850 mm) however occurs in infrequent but heavy. Due to severe mid-season dry spells this area is marginal for maize, tobacco, cotton or enterprises based solely on crop production. However, the region is ideal for livestock production.

Natural Region IV includes 33.0 % of the land which is 12.84 million ha. Lower rainfall (450-650 mm), successive seasonal droughts and periodic dry spells during rainfall season make this region marginal for rainfed maize and unreliable for cash cropping although ideal for drought resistant fodder crops.

Natural Region V incorporates the remaining 29.0 % of the land or 11.28 million ha. Rainfall is low (< 650 mm below 900m and <600 mm in the Save and Limpopo Valleys) and erratic. As a result rainfed or even drought-resistant agriculture is not possible in this very hot area. Only extensive cattle, game ranching or irrigation cropping occurs in this area.

Economy

The agriculture sector dominates the Zimbabwean economy employing 25% of labour in the formal economy and contributing 15% to GDP and 35% to export earnings (CSO, 1987). This output is mostly supplied by the large scale sector. However, communal farm production is also significant contributing 32% of total agricultural output in 1986 (Ashworth, 1990). This does not account for the 61% of production which is retained for household consumption. There is also considerable sales of agricultural products through informal markets.

The forestry sector in comparison is relatively small. Forestry production only includes about 110 000 ha of intensively managed pine and eucalypt plantations which are under control of the Forestry Commission or large companies (Forestry Commission, 1991). However, Zimbabwe is self-sufficient in wood with an expanding panel and pulp industry. This primary processing generates about US$40 million annually (World Bank, 1992).

The manufacturing section is highly self-sufficient. In terms of value of output it is the largest productive sector and represented about 26% of GNP in 1988 (Central Statistics Office, 1989). Over 6 000 different products are manufactured. This manufacturing is concentrated in the

major urban centres with over 70% in Bulawayo and Harare. Mining and quarrying as well as other industries and services also contribute to the Zimbabwean economy.

Political Institutions

The Ministry of Local Government and Urban Development (MLGRUD) is directly responsible for all rural development. They provide state funding to the District Development Fund (DDF) and to the District Councils. The Department of Rural Development (DERUDE) are responsible for planning and rural development projects and policies. This development process, administered by MLGRUD, is conducted through the Provincial Development Committee (PDC), District Development Committee (DDC), Ward Development Committee (WADCO) and the Village Development Committee (VIDCO).

At the provincial level planning is done by the Provincial Governor supported by the Provincial Councils (PC). The provincial work is supported by a PDC which carries out the Council's work. However these plans are usually not incorporated into the National Development Plan due to a breakdown at the ministerial level. Therefore funding is usually unavailable for the development work.

Districts are headed by District Administrators who preside over the DDC. These carry out public works by producing a District Development Plan based on the ward and village

plans. They are advised by the District Natural Resource sub-committees, however these committees are not taken seriously because they do not generate funds for the District Councils. The District councils have statutory responsibilities with respect to enactment and enforcement of by-laws, provision of services and community facilities and investment in initial infrastructure. The Rural District Councils Act empowers the District Councils in terms of communal land use and conservation by-laws (1985).

The local level involves the WADCO and the VIDCO. The role of the WADCO and VIDCO is to make local decisions incorporating the needs and priorities of the area. These needs are presented to the District Council whose purpose is to carry out the council policies and projects. The VIDCO, coordinates village development plans. However due to internal institutional conflicts over resource allocation the VIDCO is weakened. As a result some traditional conservation approaches have been lost or repressed. The WADCO is even weaker with no basis for decision making. Although the WADCO has more identifiable leadership, through the local councillor, it is susceptible to more political interference and thus conflict.

Population, Land Use & Distribution

Zimbabwe has a national population of 10 401 767 with an annual growth rate of 3.13 %. Urban centres contain about 27% of the population. Harare, the capital city, has a population of 1 184 169 while Bulawayo has 620 936. People resident in commercial farms and mining towns make up around 17% of the population. The remaining 56% of the population reside in the communal areas.

There are five major land uses in Zimbabwe including: Communal areas; Resettlement areas; Commercial Farms; Parks and State Forests; and Urban areas. (Map B.3)

TABLE A.2 Land Use Categories

Land Use	Area (million ha)	Percentage of Total Area
Communal Areas	16.3	42.0
Resettlement Areas	3.3	36.2
Commercial Farms	13.5	6.8
State	5.6	14.4
Urban and other	0.3	0.6

Source: HIFAB, 1989

TABLE A.3 **Percentage Distribution of Land Use by Agro-Ecological Regions.**

Region	Communal Area	Resettlement Area	Commercial Farms	Other
I	0.7	11.0	3.5	8.4
II	8.7	33.7	46.4	1.3
III	17.1	38.1	55.4	18.7
IV	47.6	15.3	62.1	28.8
V	25.9	1.9	32.1	43.8

Source: Ministry of Lands, Agriculture and Rural Resettlement, Government of Zimbabwe, 1989.

The Communal areas cover 16.3 million hectares or 42% of the land and accomodate 57% of Zimbabwe's population. 73.5% of the Communal Areas are located in agroecological areas IV and V (Map B.4).

Commercial Farms number about 4 500. These incorporate 13.5 million hectares which is 36.2% of the country. About 17% of the population lives on this land. This land is generally located in agroecological areas II, III, and IV. These areas are suitable for agriculture, particularily cash crops for export. Farms are individual tenure farms and range from about 1 500 ha in regions I and II with farms of 2 000 - 3 000 ha in regions III and IV. These farms are generally located on high potential land, therefore productivity is high. However, due to the large size of these farms, only about 60 % of this high potential land is utilized while the remainder lies fallow.

Demarcation for park and state forests has incorporated 14.4 % of Zimbabwe's land for conservation purposes. These have been run along ecologically sound principles following prescriptions per agro-ecological zone. There have however been conflicts with neighbouring communal areas due to their exclusion from using resources in these areas.

APPENDIX B

MAP B.1 Major Velds of Zimbabwe

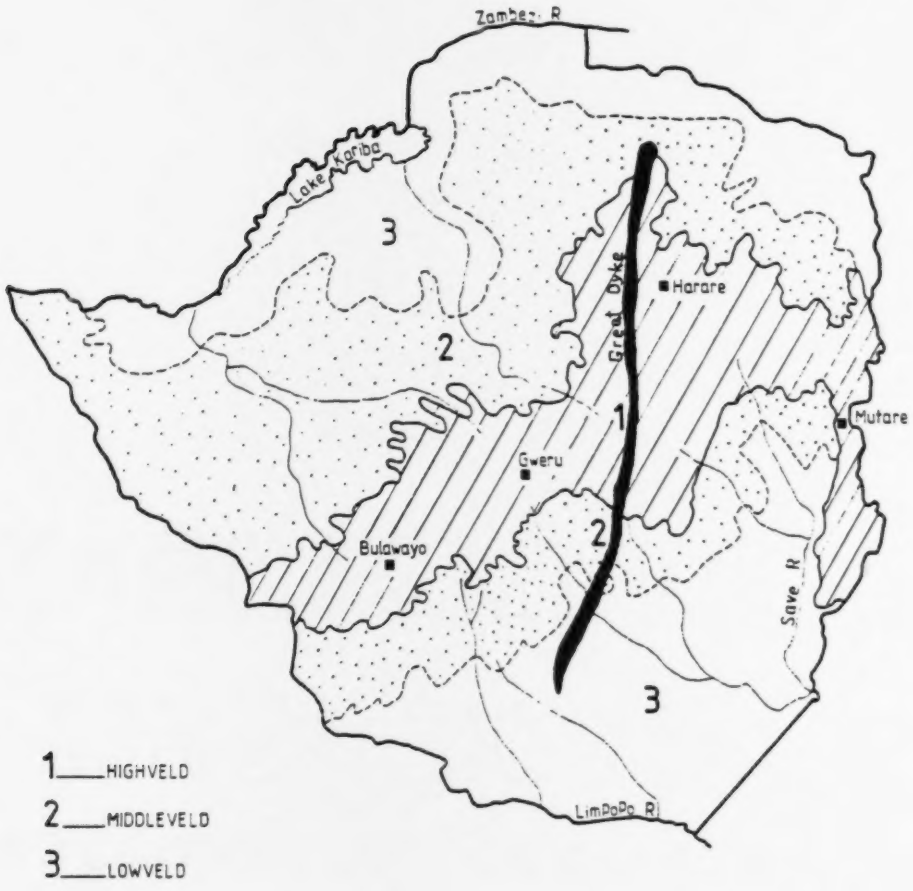
MAP B.2 Agro-Ecological Regions

MAP B.3 Distribution of Major Agricultural Land Use Categories

MAP B.4 Natural Regions & Communal Lands

Map B.1

MAJOR VELDS OF ZIMBABWE



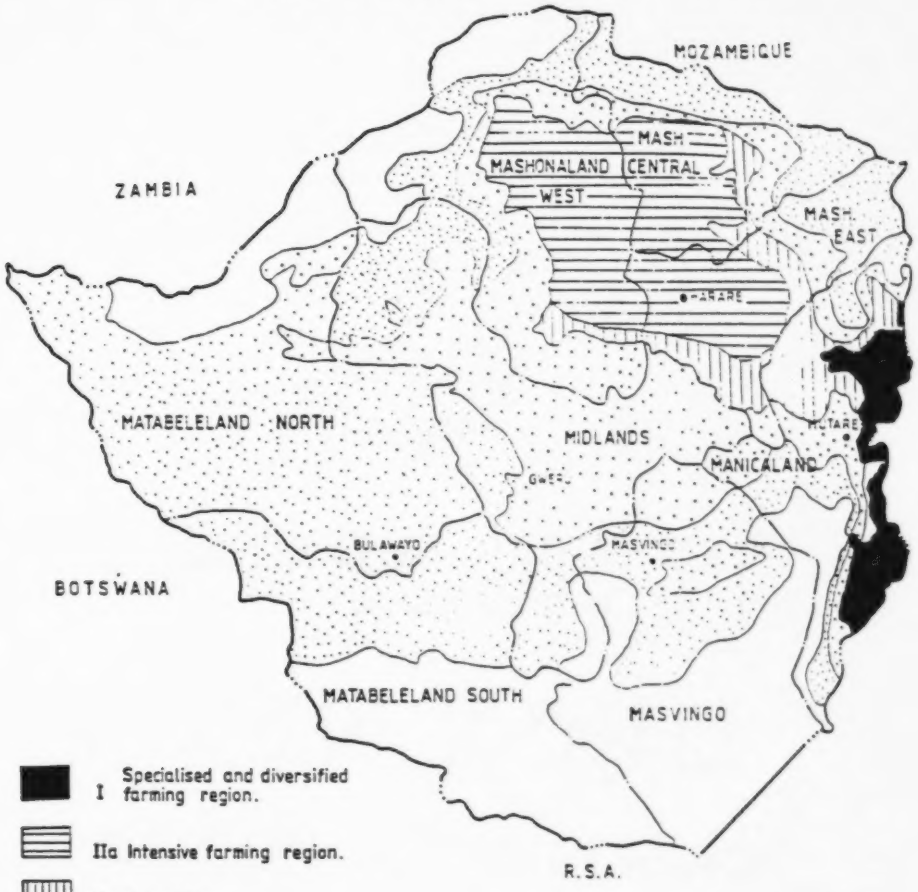
Scale 1 : 1000 000

ENDA-ZIMBABWE
ENVIRONMENT DIVISION
CARTOGRAPHIC SECTION
53/08/91

Map B.2

ZIMBABWE

Agro-Ecological Regions



Map B.3

ZIMBABWE

Distribution of Major Agricultural Land Use Categories

•.....Major cities

.....Large scale commercial farming area.

.....Communal farming area.

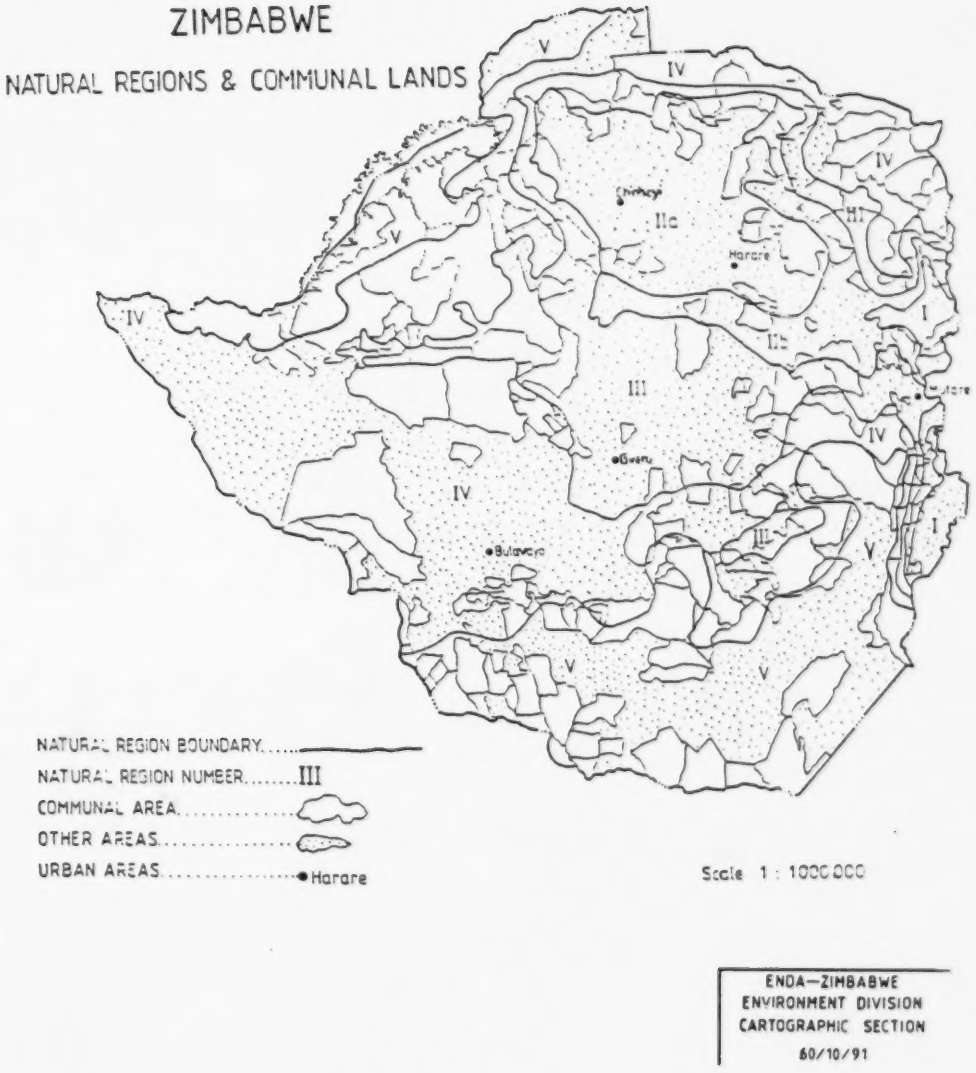
.....Resettlement area.

.....Other land uses eg. National Parks.

Scale 1 : 1000 000

ENDA-ZIMBABWE
ENVIRONMENT UNIT
CARTOGRAPHIC SECTION
15/5/91

Map B.4


ZIMBABWE
NATURAL REGIONS & COMMUNAL LANDS
V
IV
IV
IIIa
III
Harare
IV
I
IIb
III
IV
Gweru
IV
Bulawayo
III
V
I
V
V
NATURAL REGION BOUNDARY.....
NATURAL REGION NUMBER.....III
COMMUNAL AREA.....
OTHER AREAS.....
URBAN AREAS.....Harare
Scale 1 : 1000 000
ENDA—ZIMBABWE
ENVIRONMENT DIVISION
CARTOGRAPHIC SECTION
60/10/91

APPENDIX C

TABLE C.1 Botanical Index

TABLE C.2 Inventory of Wildlife Utilized in Zimbabwe

TABLE C.3 Nutritional Content of Wildlife

TABLE C.4 The Use Of Indigeneous Trees For Insects

TABLE C.1 Botanical Index

SCIENTIFIC NAME	INDIGENEOUS NAME
Acacia gerrardii	
Acacia giraffae	
Acacia nigrescens	
Acacia nilotica	Munzamutema
Acacia tortilis	
Azanza garckeana	Mutohwe
Baikaea plurijuga	
Bauhinia petersiana	Mubhondo
Bauhinia thonningii	Mutukutu
Brachystegia glaucescens	Muwunze
Brachystegia spiciformis	Musasa
Burkea africana	Mukarati
Colophospermum mopane	Mupane
Combretum apiculatum	Mudziyaashe
Combretum erythrophyllum	Mutepe
Combretum hereroense	Murovamhuru
Combretum molle	Mupemberi
Combretum platypetalum	Bepu
Combretum zeyheri	Muruka
Convolvus sp.	
Cussoria kirkii	
Cussoria natalensis	
Diospyros mespiliformis	Mushuma
Diplorhynchus candylocarpon	
Ekevergia benguelensis	Muvirinyimo
Fadogia ancylantha	Mushishinwa
Julbernardia globiflora	Munhondo
Parinari curatellifolia	Muhacha
Pseudolachnostylis maprouneifolia	Mukavazviyo
Pterocarpus angolensis	Mvamaropa
Sclerocarya birrea	Mupfura
Terminalia randii	Musosawhai

Terminalia sericea	Mukonono
Uapaca kirkiana	Muzhanje
Unidentified	Mbiningwa
Unidentified	Mushenjere

TABLE C.2 Inventory Of Wildlife Utilized In Zimbabwe

Common Name	Indigeneous Name[1] (Shona:Ndebele)	Scientific Name	Notes	Source[2]
MAMMALS:				
Mouse (General name)	mbeva/mbewa			1, 2, 5, 7,
Mouse	cheramasikati	*Rhabdomys pumilio* (unsure)		11
Mouse	mbasi/mhatsi	*Dendromus melanotis*		11
House Mouse		*Mus musculus*		
Pouched Mouse	gviti/svugu	*Saccostomus campestris*		11

[1]The names preceeding the colon are Shona and the names following the colon are Ndebele. Variations in spelling are included.

[2]The following studies or sources were used. The notes with each species may be specific for the area the study was conducted in.

1. Campbell *et al* (1994)
2. Cavendish, W. Pers. Commn. Preliminary results of study In Shindi, near Masvingo.
3. Chitsiku (1989)
4. Gomez (1988)
5. Graham - Ch. 5, Field Study Results
6. Hobane (1994)
7. Hughes (no date)
8. Kinsey (1986)
9. Natural History Museum, Bulawayo. Mammal displays.
10. Natural History Museum, Bulawayo. Pers. Comm., Mrs. Rudo Sithole, Entomologist.
11. Wilson (1990). Other studies and reference books are also cited within Wilson's study.

Striped Mouse	ninga/nhika	*Lenniscomys griselda*		11
Single Striped Mouse	nhanho/shori			11
Mole	shindi			1
Shrew	mudhende/chimudenge/matuna/mudendere	*Nasilio brachyrynchus, Elephantulus myurus*		11
Rat	banya/mbende/gonzo/gozho/goso	*Tatera leucogaster*(unsure)		7, 11
Vlei Rat	dapi	*Otomys irroratus*		11
Bush Squirrel	shindi/trindi	*Paracerus cepapi*	2. Eaten very much in the past, but now rare	2, 7, 11
Rock Rabbit, Dassie, Hyrax	mbira:imbila	*Procaria capensis, Procaviidae sp.* (unsure)		1, 2, 9, 11
Unknown	siriri		Larger than mbira, long tail with white end	2
Cane Rat	manyika/zezeru	*Thyronomys gregorianus*	Not a member of the rate family	8
Greater Cane Rat /Grasscutter	tsenzi/senzi/wondo	*Thyronomys swinderianus*		7
Hare (General name)	tsuro/shuro	*Lepus sp., Pronolagus sp.*		1, 5, 11
Scrub Hare	tsuro:unvundhla	*Lepus sarcatillus*		7, 9
Red rock hare	gubwe/hubwe/pfori/pfuru:untoletsho	*Pronolagus crassiccrudatus P. randensis*		7, 9

Spring hare	nhire/mhire/gwizhu/ gwete/jengwa/ :unayelaine	*Pedetes capensis*		7, 9, 11
Honey Badger	tsera/sere/mantswane /chisere	*Melivera capensis*		7, 11
Genet	simba	*Genetta spp.*		11
Wild Cat	gora	*Felis libyca, F. caracal*		11
Civet Cat	jachacha	*Viverra civetta*		2, 11
Porcupine	njenje	*Hystrix africaeaustralis*		11
Pangolin	hamba kubvu	*Manis lemmincki*		11
Bushbuck	tsoma/dzoma/soma/ hwete/goho:imbabala	*Tragelaphus scriptus*		7, 9, 11
Duiker	mhembwe:impungi	*Sylvicapra grimmia* (Crown duiker), *Cephalophus monticoles* (Blue duiker)		1, 2, 5, 7, 9, 11
Steenbok	mhene:ingina	*Raphericus campestris*		5, 7, 9, 11
Klipspringer	ngururu:igogo	*Oreotragus oreotragus*		2, 9, 11
Dikdik		*Madoqua kirki, Rhynchotragus sp.*		11
Wildpig	nguruve			5
Warthog	mjiri	*Phacochoerus aethiopicus*		2, 11
Kudu	nhoro:ibhalabhala	*Tragelaphus strepsiceros*		1, 2, 5, 7, 9, 11
Impala	mhara:impala	*Aepyceros melampus*		2, 5, 9, 11

Wildebeest	mvumba:inkonkoni	*Connochaets taurinus*		9
Tsessebe	nondo:inkolomi	*Danaliscus lunatus*		9
Zebra	mbizi			2
Hippopotamus	mvuu	*Hippopotamus amphibius*		11
Monkey	shoko		Few people eat	2
Baboon	gudo:indwangu	*Papio ursinus*	Very rare to be eaten	2, 9, 11
Tortoise	kamba			1
Snake	nyoka			1
Leguaan	gwama			1
Birds	shire/shiri			1, 5
Dove	njiva			2, 5, 11
Guinea Fowl (helmeted)	hanga/hendele	*Numida meologris*		1, 2, 5, 9 11
Francolin	chikware/chikwari/ hware	*Francolinus sp.*		1, 11
Harlequin quail	chihuta			11
Quelea/ Melba Finch	chikumgura/mazazo	*Quelea quelea*		1, 5, 11
Weaver bird	qwetura/majesa			11
Red-shouldered glossy starling	husvu			2, 11
Long-billed crombec	dhimba			11
Fork-tailed drongo	nhengure			11

unidentified	chidhiti			11
Pipits	ndondodza			11
INSECTS:				
Caterpillar[3]	madora:amacimbi	*Coimbrasia belina*	General term for edible caterpillar, Mashonaland	1, 2, 4, 5 10
Caterpillar	magandari/gandari		2. Jan-Feb. feed on *C. mopane*[4] & *B. spiciformis*	2, 4
Caterpillar	harati:amacimbi	*Cirina forda*	1. Dec-Jan feeds on *B. africana* 11. still common, but less times a yr	2, 4, 5 11
Caterpillar/ Mopane worm	magandari/gandari: amapipi (mahonja is collective term for *G. maia & G. belina*)	*Gynanisa maia*	Dec-Jan, Mar-Apr	6
Caterpillar/ Mopane worm	matyonza:amacimbi,	*Gonimbrasis belina*	Matabeleland. Restricted to *C. Mopane* on clayveld regions IV & V.[5] 10. Dec-Jan, Mar-Apr	1, 6, 10
Caterpillar	nhemeteme	*Gonimbrasia belina, G. zambesina* (unsure)	very rare, feeds on *J. Globiflora & D. mespiliformis*	11

[3]Wilson (1990) mentions species found in other studies to include *Imbrasia epinethea*(madora) on *J. globiflora & Brachystegia spp*, masenda, matyonza, ndambakurayira, nhayataya, pferepfe and zuvisi.

[4]The following tree species are included in Table C.1, Appendix C.

[5]Bradley (1992)

Caterpillar	nhemeteme		feeds on *C. mopane*	4
Caterpillar	tyonza	*Gonimbrasia belina*	rare, feeds on *C. mopane, S. birrea & D. mespiliformis*	11
Caterpillar	nhete nhowa njanjenjanje shongwa sinini tsambare	*Sphingida spp*		4
Caterpillar	avamukundu	*Imbrasia ertli*	11. now very rare. feeds on *J. globiflora & B. glaucescens.*	3, 9, 11
Caterpillar	fenje	*Bunaea alcinoe*	virtually extinct. feeds on *C. kirkii & C. natalensis*	11
Caterpillar	gandari/siriri	*Lobobunaea*, possibly *Pseudobunaea & Gynanisa spp*	still found, feed on *J. globiflora, B. spiciformis, C. mopane & B. afrcana*	4, 11
Caterpillar	hondokotowa	*Thanmatopoedae sp*	feed on *J. globiflora*	11
Caterpillar	nhova	*Herse convolvuli, Anaphe panda*	common. *H. convolvus* feeds on *Convolvus spp. A. pande* cocoons in *J. blobiflora & B. glaucescens,* feeds on *D. candylocarpon*	8, 11

Caterpillar	sindigwiza	*Micragone spp.* or *Goodia kunizei*	Feeds on *J. globiflora*	11
Caterpillar	motho			5
Cricket	makurwe	*Gryllidae sp.*		5, 10
Sand Cricket	gugwe/gurwe	*Brachytypes membranaceus*	2.Feb-Mar. 11. during rains, crop pest	2, 4 11,
Black cricket	chikugwemuroi chenya chikumbwe chikundywe	Chenya found in *U. kirkiana*	2. Eaten in drought	2, 4 11,
Mole Cricket	ndororo	*Curtilla africana*		4
Locust	zwiwiza:intethe	*Locustana sp.*		4
Locust	hwiza	*Acrididae sp.* (green)		5, 10
Locust (medium-sized, red, migratory)	bandairo		late rains & cold, dry season, rare	11
Locust (migratory)	chinjike		late rains & cold dry, rare	11
Locust (large, solitary)	mhashu/mapfunde/ barigango	*Cystocanthoseris sp*	rains, common	2, 4,11
Locust (winged)	mbumu	*Gastrimargus volkensi*		4
Locust (winged)		*Namadacris septemfasciata*		3
Grasshopper (general name)	gwiza			4
Grasshopper (green)	madhumbudya		Jan-Dec	2

Grasshopper (large, winged)	boromoro/bnoromhori		common	11
Grasshopper (wingless)	:boromhori	*Pamphagina lamarckiana*		4
Grasshopper (large)	bambamukota, bombomupota	*Pamphagina lamarckiana*		4
Grasshopper	bambamukota	*Ornithacris cyanea*	all year, common	11
Grasshopper (large, wingless, brown)	bupu/bhupu		during harvest, common	11
Grasshopper (small grey)	chindanga			11
Grasshopper (solitary)	njeru	*Nomadacris septemfasciata*	rains, rare	11, 4
Grasshopper	tsumwatsumwa			4
Grasshopper (long-headed)	mutsumwarumwa			4
Grasshopper	njororo	*Curtillia africana*	still found	11
Grasshopper	shumvashumva/ tsumavatsuava	*Truxaloides consiriclus*	rains, cold dry, common	11
Grasshopper	dhusbudya	*Ruspolia differens*	rains, swarms in 1988	11
True Bug	bembere		first rains	11
True Bug	harurwa	*Eucosternum delagorgnei*	cold, dry, common	11
True Bug	nharara		cold dry, common	11

Cicada	nyenze, nyezhe, nhyenze		2. Oct - Nov. Eaten in drought 11. hot, dry season, common. *C. mopane*	2, 11
Termites		*Macrotermes spp*		6, 8
Termite (soldier)	majuru:amagenga		Aug - Nov	1, 2, 4 5, 10,
Termite (flying, female)	ishwa:izinhlwa	*Termitidae sp.*(unsure)		1, 2, 4, 5 10
Termite (winged)		*Macrotermes natalensis*		3
Tree ant	dendemafuta			6
Flying ant	shwarara		Nov-Dec	1
Ant	harungwa mise		Mar-May	
(fat beetle-unsure)	Tsambarafuta:amahlabusi	*Carebara vicua*	2. Nov-Dec. 11. rains, common	2, 4, 5, 9, 11
Beetle	ndere	*Eulepidida masnoma*	hot, dry, common, found on *J.Globiflora, B. spiciformis*	11
Beetle	mandere	*Scarabaiedae sp.*		5, 10
Chafer Beetle	ndere/marupwa	*Rutelida spp.*		4
Christmas Beetle	ndiza	*Eulepida masnona*		4
Goliath Beetle	maivendere			4

TABLE C.3 Nutritional Content of Wildlife

Wildlife	Moisture (g)	Protein (g)	Energy (kcal)	Carbohydrate (g)	Fat (g)
African giant rat	65.99	18.99			11.0
Grasscutter	65.8-77.4 69.7	20.7-26.2 18.8			0.7-7.4 8.9
Forest Genet	31.8	55.4			9.3
Duiker, Crown	74.6	20.8			3.4
Duiker, Grey	59.5	33.4			2.0
Bushbuck	47.6 74.4	50.9 21.6			12.2 2.9
Birds (raw)	68.7	19.7	128.7	0.2	7.8
Ants (flying, fresh, raw)	67.8	12.9	140.3	1.2	8.0
Ants (flying, cooked, dried)	2.9	38.3	634.5	6.0	46.9
Caterpillars (fresh, raw)	77.3	14.8	98.7	2.5	3.5
Caterpillars (cooked, dried)	8.5	5.0	386.8	17.3	12.6
Locusts (fresh, raw)	72.4	15.1	140.0	2.6	8.3
Locusts (cooked, dried)	39.0	31.0	319.0	(8.0)	19.7
Domestic Meat					
Beef	73.8	19.6			12.0
Sheep	78.5, 62.5	17.2, 16.8			2.9, 19.4
Pork	64.8, 41.1	19.4, 11.2			13.4, 49.0

Source: Asibey (1987); Ajayi (1979); Chitsiku (1981). See Chitsiku (1981) for further nutritional breakdown.

Units: % proximate composition/100g, edible portion

TABLE C.4 The Use of Indigeneous Trees For Insects

Indigeneous Tree[1]	Insect Found On Tree If Specified[2]
Mubhondo	
Mbiningwa	
Muhacha	
Mukarati	Caterpillars
Mukavazviyo/Mutsotsowa	
Mukonono/Msusu	
Munhondo/Mutondo	Mandere, Madora
Mupane	Madora
Musasa	Mandere
Mushenjere	
Mushishinwa	
Mushuma	
Mutohwe	
Mutukutu/Muchekecha/ Musekesa	
Muvirinyimo	Madora
Muwunze	
Muzhanje	

Source: CASS (1992).

[1]The scientific names are found in Table C.1, Appendix C.
[2]There is also reference to specific trees for certain insects in Table C.2, Appendix C.

APPENDIX D

TABLE D.1 Chinamura Field Results

TABLE D.2 Store Prices

TABLE D.3 Nyanga Field Results

TABLE D.4 Timeline

TABLE D.1 Chinamura Field Results

Household id[1].	Household Composition	Wealth Grouping[2]	Remote-ness[3]	Species Utilized	Amounts[4]	Reasons Not to Consume	Marketing[5]	Comments
ch-cp1	headman, wife*, grandson, grand-daughter	lower	1	mice, ishwa	mice: April, 6-10/day, 1 month	No one to hunt, lack of wildlife	ishwa: $1.50-2/cup, 6-7c/day, 2day/mo, 2mo	
ch-cp2	husband, wife*, 4 daughters & sons, grandson, grand-daughter	lower	1	mice, ishwa, locusts, tsambarafuta	locusts & tsambarafuta: few	Lack of wildlife	mice:$0.15-0.30 each, 15-20/day,3-4times/wk ishwa:$1/small cup & $2/large cup, sell 5 or more c/day from home, sell more at mkt 2 times/wk, 2 mo.	Not interested in more wildlife because destructive to crops and can grow enough food.
ch-cp3	uncertain, young girl* & parents	lower	1	none		No one to collect (children in school & parents work)		
ch-cp4	husband, wife*, husband's younger brother, child	middle	1	mice, hares, buck	hares: 1-2/wk buck: rare	Taste preferences	hares: do not sell but have paid $10-12/hare	Would like environment where mice & birds can live even if they destroy crops because these are important & easy to control.

*Denotes the person who was interviewed.

[1]ch=Chinamura communal area; cp=Chipatiko village; tg=Tagarira village; cd=Chadarikire village; bp=Bapatu village; mr=Murape village; mn=Munywira village

[2]Households are grouped into higher, middle and lower wealth groupings according to observations about their holdings.

[3]Classified from 1-3 according to access to main roads and stores. 1 is least remote, 2 is average, while 3 is very remote

[4]dish=12" diameter, 4"height; basin=18"diameter, 6"height

[5]Prices are expressed in Zimbabwean dollars.

ch-cp5	husband*, wife, 6 children	middle	1	mice, ishwa	mice: Apr-Sept, dig once/wk=200 mice, set 40-50 traps ishwa: Nov-Dec, 3-5 buckets	Lack of wildlife, have domestic rabbits so do not need to hunt hares.	mice:$0.50-1 ea, 20-30/weekend at beerhall ishwa: $2/sml cup & $3/lge cup, sell 6 c/ day at home but if have to go to mkt & sell >10c/day, overall sell >20 c/wk	Income from wildlife is small but important. Some wildlife is destructive but if you can hunt to destroy it then can benefit. Interested in wild game for children to see.
ch-tg6	headman*, 6 adults	No grouping (interview in field)	1	birds, mice, hares, wild pig, buck, ishwa, locust, madora, tsambarafuta	mice: late Apr-early May, abundant hares: 1-2/day		madora: buy	Would like to see more wildlife even if they can't use it because want wildlife for their children who are interested and consider wildlife more important than adults.
ch-tg7	widow*, grand-daughter (sons in Harare)	higher	1	mice, birds, madora	mice: 6/day, 2 wks		mice: do not sell but could sell at beerhall for $0.5-1 ea madora: buy for $2/package	Want to have wildlife for their children, however these wildlife (large) needs to be protected of they will be hunted
ch-tg8	husband, wife*, 5 children, worker	higher	1	ishwa, madora	ishwa: collect & buy	Taste	ishwa: buy madora:buy	neighbour's comments: Education about conservation of resources is important Wants mice and hare for his children to see. Large game should be in a park where people can pay to see them and the money can pay to protect them

ch-tg9	husband, wife*, 4 children, mother-in-law, worker	higher	1	birds, hares, ishwa, locusts, madora	birds: 2-4 birds/trip each weekend hares: 1/mo locusts: 1 or 2 during harvest	Not interested in mice because can't differentiate betwen rats	birds: take orders, $0.80, 1, 1.50 each madora: buy every 3-6 mo, $14/bag of 10 packages	Would like to keep some wildlife as pets because interesting
ch-tg10	wife*, 4 children, husband & son work in Harare	higher	1	birds, ishwa	birds: 5/day, once/wk during school, every day during holidays ishwa: rare. 3-4 times/wk, also buy	Not interested in mice because can't differentiate between rats. Not interested in madora.	ishwa: buy for $1/c	Wildlife is important but where would they live
ch-cd11	headman*, 4 wives, 15 children	higher	2	mice, ishwa, madora	mice: harvest mo, 30-40/day but not every day, preserve extra ishwa: Nov-Dec, 3 buckets/day when out		ishwa: sell but interviewee unsure of prices madora: buy 4 packages/wk for $8.50/package	Would like more wildlife, especially large game and they would hunt more because wildlife is regarded as a main form of meat. Instead they use substitutes. WTP: $40/mo towards a wildlife project to increase wildlife because presently pay $40/wk for meat.
ch-hp12	headman*, 3 wives, 13 children	higher	2	mice, birds, ishwa, tsambarafuta	mice: end of Apr-beginning of May, 1 wk, 20/day birds: occasionally get one by chance tsambarafuta: few ishwa: 1 bucket/day	Lack of wildlife	mice: no extras to sell, do not buy because some people sell rats	Interested in small & large wildlife except hyena & leopard because threat to cattle. Would substitute back to hunting if there was wildlife again. WTP: $20/mo

ch-hp13	grandmother*, 2 grandsons	middle	2	ishwa, tsambarafuta	ishwa: 1 bucket/day tsambarafuta: collected singly by children	No one to collect, Lack of wildlife		Interested in wildlife but since it is destructive she doesn't want it, except birds which aren't destructive because there is no sorghum in the area.
ch-hp14	man	No grouping (interview while out walking)	2	birds, ishwa, tsambarafuta	birds: 1-2/day, 2-3 times/wk	Religion (mice, madora) Lack of wildlife & no one to collect (buck, hare)		Interested in animals however no thickets for them.
ch-hp15	husband, wife*, 4 grandchildren	lower	2	ishwa	ishwa: 1 bucket/trip	Religion (birds, mice, hares, tsambarafuta), No one to collect (birds)	ishwa: $1/c. 10c/day, 2-3 times/wk	Likes to have wildlife around & feels that they are created by God and therefore have a place on earth which we can't take away.
ch-mr16	husband, wife*, 11 married children & their families	higher	1	birds, ishwa. locusts. tsambarafuta, madora	birds: 1/mo ishwa: Nov-Dec, 20L/trip,variable number of trips/wk locusts: harvest, handful tsambarafuta:very few madora:only buy	Taste (mice), None around (buck, hare)	ishwa: $1/c, 30c/day, 2-3 times/wk madora: buy 1 package/wk, $2.50/package	Mice & hares destroy crops so don't want them around. Very interested in ishwa because good for diet & no hazard to crop. Big game is seen as hostile & a hazard.

ch-mr17	husband, wife*, 3 daughters & sons, grandmother	higher	1	birds, hare, ishwa, tsambarafuta	birds: 2-5/day, once/wk (weekend) hare: during school holiday (3.5 weeks), 1/holiday ishwa: 1 jar/day after rain, limited because no mound on property so can't trap but can only get ones which leave othereyards. tsambarafuta: few			Ishwa is important. It saves a lot of money & provides a change in diet. Not interested in large gamd because no used to them & scared of them. Interested in birds because they are not harmful & are attractive.
ch-mr18	mother*, daughter, 2 grandsons	higher	1	None		None nearby. Have enough money to buy meat & the butchery is nearby		If there was wildlife nearby then they would collect wildlife & buy less meat, although would still buy meat for taste and a change. Currently spend $6/kg x 3 times/wk on meat. WTP: $10/mo to be able to legally hunt hares and buck.

ch-mr19	mother*, son, daughter & husband, 7 grandchildren	No grouping (interview in field)	1	birds, mice, ishwa, madora	birds: 4-6/day, once/wk (weekend) mice: May-July, 30/day, dig 2 times/wk, traps once/wk ishwa: Nov-Dec, 1 bucket/trip madora: seldom		Don't sell so found it hard to give a price but suggested that she would sell them for $0.50/bird mice: sell surplus at beerhall on weekend, $0.20-0.30 ea (depending on size), 20/wkend ishwa: sell with vegetables at mkt in Harare, also buys from neighbours for about $5/basin to sell in Harare, sell for $1/c, 10c/day madora: buy 1kg every 3-4 months for $3 or more/1 kg bag	Income from wildlife is small but used to buy bread, sugar & soap. Wildlife is also important because then spend less on meat. She needs them because they are part of her life and she would like more. sugar=$6.50/2kg, once/wk bread=$2.70/loaf, 2 loaves/day soap=$5/bar, once/wk meat=$10/wk

ch-mr20	father (away during week), daughter* & her son,	lower	1	ishwa madora	ishwa: very few		ishwa: buy for $1/c madora: buy for $2.50/package	During drought they have no relish. meat=$10/wk
ch-mn21[6]	headman*, wife, 5 children	higher	1	birds, mice, hares, buck ishwa, locusts, tsambarafuta, madora, mandere,	birds: 2-3/day mice: trap every day, 60/day hares & buck: rare, only by chance ishwa: Nov-Dec, 1 bucket/trip, 2-3 times/wk locusts: 1/2 dish/day, 1 day/wkend tsambarafuta: children collect as treat madora: Nov-Dec, 1 dish/trip, twice/wk mandere: Nov-Dec, 1 dish/day, every day		mice: buy 2-3 times/wk because close to shops, $0.30-0.50 each	Interested in wildlife but large game would be killed by people for meat. Also no room for wildlife because of population. When collecting wildlife he doesn't go to the butchery at all. meat=$25-30/mo
ch-mn22	headman*, 2 wives, 4 children	No grouping (Interview at hshld ch-mn21)	1	birds, mice, hares, buck, ishwa, locusts, tsambarafuta, madora, mandere	birds: harvest, 1-2/wk mice: Apr-July, dig 20-30/day, trap 10-20/day, 3-4 times/wk collection of other species is same as for ch-mn21		birds: have never sold and could not even suggest a price mice: $0.30-0.50 each locusts: buy for $0.10-0.20/plateful	meat: $25-30/mo
ch-mn23	headman, 2 wives, 15 children	higher	3	mice, hares, buck, ishwa, locusts, tsambarafuta, madora, mandere	mice: 100/day (dig 10-20/hole), once/wk other wildlife same as with ch-mn21			Collect a lot of mice because live far from the shops meat=25-30/mo

[6]Interviews with ch-mn21, ch-mn22 and ch-mn23 were done simultaneously so the views and much of the information listed under ch-mn21 applies to the other two as well.

ch-mn24	mother, sons* & wives*, daughters, grandsons	lower	1	birds, ishwa, tsambarafuta, mandere, madora	birds: 3-5 every 2 wks ishwa: 1 sack/wk tsambarafuta: Nov-Dec, 2 kg/trip, 3 times/wk mandere: 1 month at beginning of rainy season, 1 dish, once/wk	Religion (mice, hares), No one to collect (hares), Locusts not eaten because feel the carry cholera	ishwa: sells a bucket or less madora: buy for $3/package, not often because far from shops	son: Don't eat some wildlife but do eat a little although not considered important to diet. However, wildlife is considered as important as human life so shouldn't be disturbed wife: Wildlife is important to the diet however she isn't interested in them living there.
ch-mn25	woman*, sister & her older son	middle	3	birds, mice, ishwa, locusts	birds: 2 or 3 while herding on weekends mice: 10-20/trip, twice/wk locust: 5/day on weekends		ishwa:buy 2 c/wk for $1/c	Wildlife not considered important to diet. If there was more around she would eat more but otherwise not concerned with having or eating more.

ch-mn26	husband*, wife*, father's mother, 5 children (2 absent?), young brother & wife & 3 children	lower	3	birds, hare, wild pig, ishwa, locust, tsambarafuta makurwe,	birds: 2/wkend hare: 0-1/trip, 4-5 trips/mo wild pig: rainy season, 4-5 day trip, 2 pigs/trip, also hunt while crops are growing ishwa: Nov-Dec, 1-3 buckets/day, 3 times/wk, variable, about 1 sack/wk locusts: Apr-May, 1dish/day, every day of harvest, few around tsambarafuta: first 3 wks of rains, 1 basin/trip, 3 times/wk makurwe: 10" cup/ trip, once/wkend	Religion (mice, madora)	birds: have never sold and can not suggest a price ishwa: $1/c, $30-40/day sold from home	Belief that can't catch wildlife to sell but can collect in bulk for own use. Wild pigs are a crop hazard. The hunting season is also a busy time with crops so if busy don't hunt. Hunt more during the rainy season. Income from ishwa is a very small portion of total income however it is used for sugar, soap and clothes. But since it is a small portion he is not too concerned.

ch-mn27	n'anga*, husband, daughter, 4 grandchildren	higher	3	mice, ishwa, locusts, tsambarafuta, makurwe, mandere,	locusts: every day during harvest, 1 dish/day tsambarafuta: 2 kg/wk, 3 times/wk makurwe: 60, once/wk while herding on weekends mandere: 1 bowl/wk	Religion (n'anga doesn't consume mice), No one to collect (birds, hares)	ishwa: buy 3c, twice/wk for $2/c	Wildlife helps a lot because can substitute for meat during the rainy season(buy 1/2 kg instead of 1 kg of meat). Would like more wildlife because it is part of their life but don't want hostile wildlife (leopards, lions, baboons). Would like kudu & buffalo for meat. However also just want wildlife to see. N'anga: Doesn't use wildlife in her medicines and can't get wild skins. People don't want wildlife because the children are scared of it. The wildlife understand this because they have gone away. Better to take the children to a game park.
ch-mn28	woman*, 2 daughters, 8 grandchildren	higher	3	ishwa, makurwe	makurwe: collect occasionally ishwa: only buy	No one to collect (mice, birds), None around	ishwa: buy from Harare, neighbours don't sell because would have to sell cheaper	Interested in small game but scared of large game because of young boys herding. Doesn't have money for meat but would probably substitute kapenta (fish) instead of wildlife.

ch-mn29	husband, wife, 2 children, grandmother	lower	3	ishwa, locusts, madora	locusts: very few (4 recently)	Taste (mice, birds)	ishwa: buy 1c per season from neighbour for $1.50/c. madora: buy 1 package/year for $2.40/package	Might hunt more if more wildlife, would depend on the male of the household. Would not mind having more wildlife around even if it can't be hunted.
ch-mn30	mother*, sister*(visiting), 1 son & wife, 2 sons, 1 daughter, 6 grandchildren	middle	3	birds, ishwa, locusts, tsambarafuta	birds: collect once/wk while collecting wood but may not always get some locusts: very few (3 recently) tsambarafuta: 1c, 3 times/season	Religion (mice, wild pig, mandere)	ishwa: buy 3 small cups, twice/season for $1/c, costs $0.50/small lidful (4"diameter)	Meat is expensive so they don't buy much. Relationship to wildlife is limited by religion. Attractive to have wildlife in environment. Large wildlife is desired for meat but not interested in dangerous animals. Wildlife is a crop hazard but don't mind if it stays in the mountains.
ch-mn31	husband*, wife, 5 daughters, 4 sons	lower	3	birds, locusts	birds: 5/day, once/wk locusts: mid Apr-May, 5-10/day, few days/wk	Religion (mice, ishwa, madora)		Very interested in having wildlife. They would be willing to pay because then they could consume more wildlife. WTP:son suggested $400 as a one time payment; father found it very difficult but said $100/6 months. meat=$20/wk

ch-mn32	headman*, wife, 1 child	higher	3	birds, mice, ishwa, locusts, madora	birds: 1/day, once/wk mice: 1-2/day or 6-7/wk for 7-8 wks locusts: harvest, handful (12?)/day for 2 wks	None around (hares, insects)	birds: no one sells but would pay $0.90/dove & $6/ guinea fowl mice: buy if someone comes around selling them, 6 or more, 2-3 times/season for $0.20 each ishwa: buy from neighbour, 4c/time, 3-4 times/season for $1.25/c locusts: don't buy or sell but would pay $0.50/c madora: occasionally buy from Harare mkt	The environment is better with wildlife. Also wildlife supplies meat for the household therefore it is important because meat is expensive. Don't substitute mice for meat but do substitute ishwa for meat. meat=$26/2kg every 3 wks WTP: $50-60/mo
ch-mn33	husband (away), wife*, 4 children	lower	3	ishwa		No one to collect (hares, buck), Taste	ishwa: buy 2c/wk during season for $1/c	Wildlife should be in the environment even if it isn't consumed because it hs a right to live. WTP: $20/mo
ch-mn34	grandmother*, 1 son & wife & 2 children, 1 son	higher	3	birds, mice, ishwa, locusts, tsambarafuta	birds: Dec-June, 2-3/day while herding mice: harvest, 2-3/day, 2 wks ishwa: Nov-mid Jan, 1 dish/day, twice/wk locusts: Mar-end Apr, 50/day, every day tsambarafuta: 1c/season		birds: have never sold but would charge $0.20-0.30 each (small birds) mice: have never needed to buy but would pay $0.20 ea	Wildlife is important to supply meat. It is also important even if not consumed because it is different from humans. Wildlife could possibly be restored by avoiding deforestation and encouraging aforestation. WTP: $50/mo; neighbour first suggested $50/mo meat=$10/wk

ch-mn35	husband, wife*, 2 sons, 2 grand-daughters, 4 grandsons	middle	3	birds, locusts,	birds: 1/yr by chance locusts: 1 wk of harvest, sufficient for meal	Religion (mice, only eat animals that chew cud). don't eat ishwa because people buried on termite mounds and ishwa come up from there		Interested in wildlife even though not consumed due to religion. It is good for people who do consume. Nothing they can do to bring the wildlife back because it is behind a fence. They grow sunflowers & sorghum to attract birds but they leave after harvest.
ch-mn36	husband (works in town), wife*, 4 children	lower	3	birds, mice, hares, ishwa, tsambarafuta. madora	birds: 1-2/trip on weekends or holidays mice: trap 10-15/day, 1 wk hares: 1/yr ishwa: collect in bucket every day for 2-3 wks tsambarafuta: 1c, once/ yr		mice: May-Aug, buy 10/2 days for $0.30-0.50 each ishwa: during season sell every day, $1/c, 20c/day madora: buy	Doesn't feel that wildlife is important to the diet and wouldn't use more even if it was around. Don't want to kill wildlife because want it for their children. Need more trees to restore wildlife. Willing to pay because saves buying meat. WTP: $10/hshld member/mo meat=$13/kg, 3-4 times/mo

ch-mn37	grandmother*, grandson	middle	3	mice	mice: few	No one to collect (mice, ishwa, etc.)		Likes to eat wildlife but no means to collect it. Would collect it if possible. Would like more wildlife in environment because they used to be here. WTP: couldn't state an amt but would pay the amt required by anyone else.
ch-mn38	mother*, 4 sons	lower	3	birds, mice, ishwa, madora	birds: 1/mo mice: mid May-end May dig once or twice/wk, 5-6/time; Trap from mid May-end June, 40/day, nearly every day ishwa: 1L, 2-3 times/wk, 1 mo		madora: buy	If there was lots of wildlife they would collect a lot more for use and sale. Would also reduce meat purchases and the wildlife would improve the diet. WTP: $5/mo meat=$26/2 kg/mo

TABLE D.2 **Prices for Basic Goods in Stores in Chinamura Communal Area**

Store Location:	Murape	Bapatu	Munywira
Cooking Oil	$6.00/ 500 mL[1]	$5.50/750 mL $8.50/1 L	
Flour		$6.75/500g $12.50/1 kg	
Sugar	$6.00/1 kg $12.00/2 kg		
Tea	$6.00/ 500g $9.00/ 1 kg		
Soap	$3.00/large bar		
Canned food items	$3.00/small can of food		$5.55/can of beans $3.50-$4.00/ can of meat
Baby cereal (Cerelac)			$7.50/box
Cookies			$4.50/200 g box
Dried kapenda (small fish)	$2.00/cup		
Dried silver fish (10" long)	$2.00 each		$3.25/package of 3 fish
Madora			$2.30/100 g package

[1]Prices are in Zimabwe $ and were collected at the time of the field study.

TABLE D.3 Nyanga Field Results

Household id[1].	Household Composition	Wealth Grouping[2]	Remote -ness[3]	Species Utilized	Amounts[4]	Reasons Not to Consume	Marketing[5]	Comments
ny-na1	headman*, wife, son, daughter, 2 grand-daughters	lower	3	guinea fowl, mice, buck, hare, huhuri, locust, cricket, madora	buck, hare: 1/mo of ea guinea fowl: off-season, 1 trip/2 wks, 1-2/trip mice: harvest (1.5 mo), 3 during entire period huhuri: 1st rains (Nov-Dec), collect 1 c, 1-3 times/season locust: 1st harvest (Mar), every day, 7 or more/day cricket: Dec-Jan, after rain, during fieldwork, catch dish or dig 1/2 c madora: mid-summer, 1 trip/yr (6 hrs), 1 dish/trip		Don't sell buck or hare because too few. Nobody in area sells. Difficult to give price but related price of a buck to a goat ($40-50) however, wildlife worth less. Guinea fowl might be compared to chicken ($20 or less) however cheaper because wild and also depends on size	Buck & locusts decreasing in number. Difficult to collect wildlife but important to their life & diet. Would like small wildlife to increase and would use them but not interested in large game because violent. WTP: $20 contribution. Worried about controlling if others contribute. Meat-2 times/yr, $20 (1.25kg) each time.
ny-na2	husband, wife*, 1 daughter, 3 sons	middle	3	mice, huhuri, cricket, locust	mice: Mar-Aug, daily, Mar/Apr 6-7/day; July 4/day (only trap) huhuri: 1st rains, 1c total cricket & locust: (same as ny-na1)	No one to hunt (buck, hare)		Not too concerned about small wildlife because can afford to buy meat. Not too interested in a project but would join if everybody else did.

[1]ny=Nyanga district; na=Nyahumbe village; nh=Nhyari village; no=Nhonheyapundi village; gu=Gukutu; nk=Nyhokwe village.

[2]Households are grouped into higher, middle and lower wealth groupings according to observations about their holdings.

[3]Classified from 1-3 according to access to main roads and stores. 1 is least remote while 3 is very remote

[4]dish=12" diameter, 4"height; basin=18"diameter, 6"height

[5]Prices are expressed in Zimbabwean dollars.

ny-nh3	husband, wife*, son & wife	lower	3	birds, mice, locust	birds: Jun-Jul, 2 trips/ wk, 4-5/trip mice: Jun-Jul, 2 trips/wk, 0-4/trip locust: children collect 1 or 2 occasionally as game	Few in numbers & no one to collect (rabbits, guinea fowl)	Nobody in area sells.	Hunt in spare time in near area. The amount they collect is sufficient so they are not worried about having more wildlife. Wildlife is an extra & they can do without it.
ny-nh4	husband, wife*, 6 daughters, 4 sons, 2 grandsons	lower	3	locusts	locusts: May-June, children collect	Religion		Large nrs of wildlife is a crop hazard & since they do not eat them they are just seen as destructive.
ny-nh5	widow*, 2 daughters, 2 sons, grandson	lower	3	mice, locusts	locusts: children collect 1 or 2 as game	Nobody to collect, most insects not available in area		Don't really use any wildlife. Don't mind having small wildlife around but scared of large wildlife. Interested in project but would have to consider cost (unemployed widow & school fees).
ny-nh6	husband*, wife, 3 sons	higher	3	none		Religion (small game), no one to collect (birds, locusts, ishwa)		WTP: $200-250. Would be very interested in project.

ny-no7	headman*, wife, 3 sons, daughter & grandson, son's wife & grandson & 2 grand-daughters,	middle	1	birds, mice, locust, huhuri	birds: neighbour boy brings over 1/wk mice: Harvest (Apr-Jun, 4 wks), every day, 2-3/day locust: Apr-May, 1-2/wk, 1/2 L each time huhuri: collected by children, very small nrs.	Not allowed to collect(rock rabbit, hare, buck, guinea fowl), not available (madora, cricket, ishwa, tsambarafuta)	mice: don't sell but would charge $0.10-0.20 each depending on size. birds: couldn't price because never sold Don't buy or sell anything because quantities are too small but would if they had extra.	There used to be a lot of small and large game (kudu, waterbuck, buck, wild pig) but moved far away because number of residents increased. Better if they are protected in National Parks, because they are a crop hazard. However, if there was more wildlife & they were allowed to hunt he would hunt because meat is expensive. A long time ago they could hunt but now they can't. Meat= 2 kg for $30/mo or substitute with 2 kg of fish for $10/mo.

ny-no8	husband*, wife*, daughter, son	no grouping (interview at another hshld)	1	birds, mice, locust	birds: 2/weekend mice: Harvest, twice/wk, 9/day locust: Apr-May, twice/wk, 1 L/day		birds: doesn't sell but would charge $0.20 ea mice: doesn't sell but would charge $0.30 ea	Heard that there used to be a lot of wildlife and his uncle hunted but now the wildlife has left. Wildlife is destructive to crops so he must kill it so it is better if the wildlfie is protected in National Parks. They could eat meat from wildlife but also need maize so must guard crops at night (wild pig) therefore better not to have destructive wildlife. Meat=$225/mo (15kg x $15/kg). Buys meat even if he would like game because there is nowhere to get the game and he would be fined.

ny-no9	woman*, 3 daughters, worker	no grouping (interview at another hshld)	1	birds, locust	birds: 3/wk locust: Apr-May, 3 times/wk, 0.5L each time	Don't consume mice because may be rats.	Doesn't buy or sell & doesn't know if anybody in the area sells	Meat is very expensive so they would rather use game. There is less game around except more wild pig which come from the National park and destroy crops. Presently there is a mice sp. that is very destructive to crops (but they are edible). Not interested in wild game because destroy crops. Meat=$20/mo (4 times/ mo for $5 each time or fish for $4.50 each time).
ny-no10	woman*, daughter, worker	higher? (remittances from son & daughter in town)	1	none		Social reasons (mice. hare), no one to collect (birds, buck), few available (locust), none (cricket, ishwa madora)		Locusts have decreased. Still lots of birds, buck & hare but have moved to protected areas. Not interested in wildlife because they are destructive to crops. Meat- may go 6 mo. without meat but son & daughter (from town) usually bring meat every 2 mo.

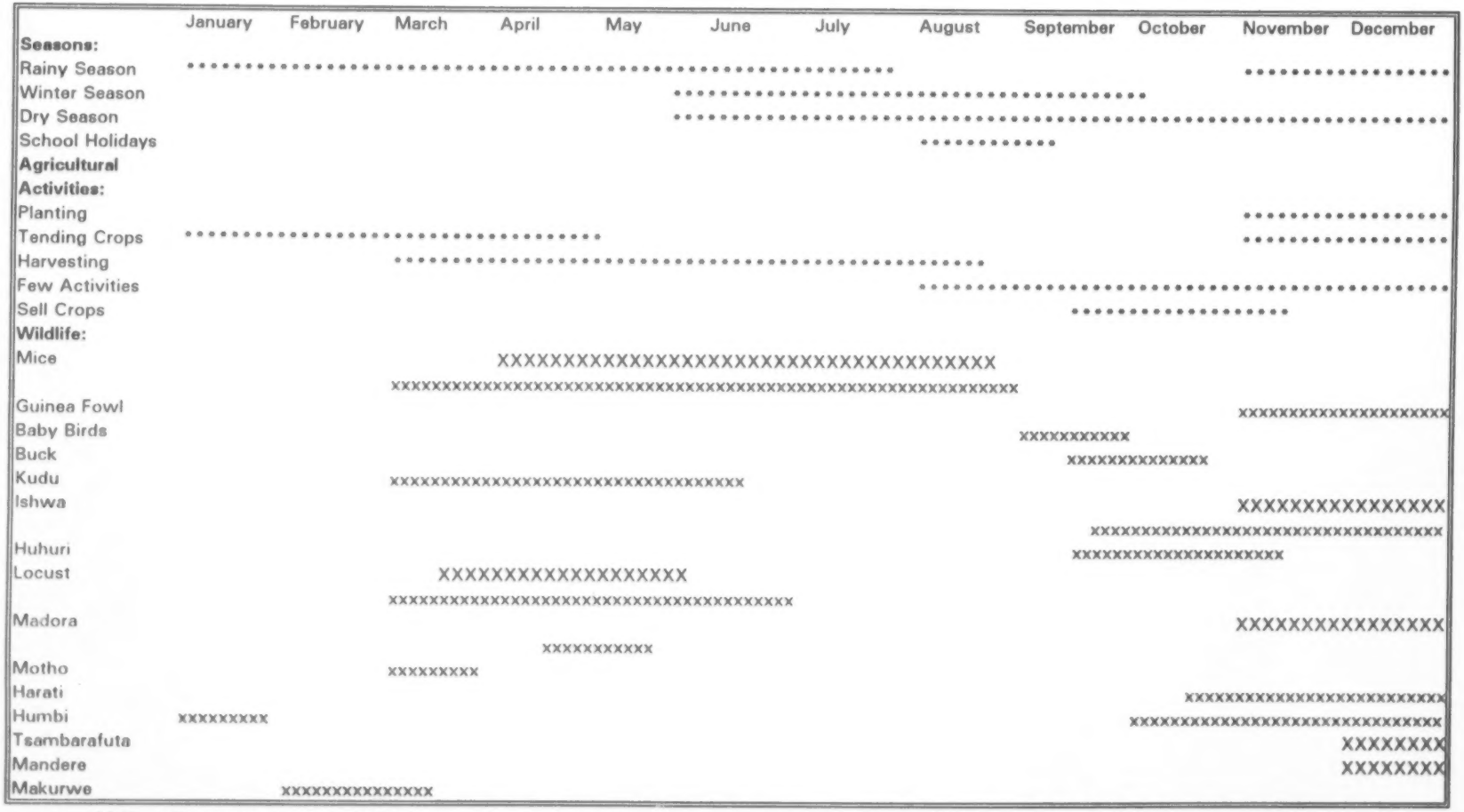
ny-no11	husband* (engineer in Harare) & wife, brother* (builder in Mutare) & wife, worker	higher	1	none	Children may collect as game & consume.	Change of times, don't know how to trap, use agricultural products instead.		Wildlife used to be used by uncles but now they are used to modern way of agriculture & use livestock for meat. Uncles used to hunt in spare time but now children are in school & also have other games to pass the time. Present generation doesn't know how to trap. No change in wildlife nrs because protected in National Parks & multiplying. Hares & buck in area but hiding. Meat-buy beast between them for $400 to provide for hshld & nearby father & brother.
ny-no12	husband (salesman in Harare), wife*, 2 daughters, 3 sons	higher	1	mice, locust, ishwa	mice: harvest (1 mo.), 2-4/day locust: harvest 10 or less/day, not every day only when available ishwa: 3-4 times/season, 1 c/time	Social reasons (birds-totem symbol), no one to collect (hare, buck, guinea fowl), not available (madora, cricket) or very few (tsambarafuta)	Don't buy or sell, nobody in locality does, but has seen them at Nyanga mkt.	Husband not availalbe to hunt because only home on weekends and not interested in hunting. Decrease in wildlife from long ago but not interested in more wildlife because destructive to crops. Meat=$6/wk (twice/wk, $3 each time).

ny-gu13	headwoman*, husband, 3 grandsons, 5 grand-daughters	middle	1	mice, buck, ishwa, locust, madora	mice: Jun-Aug, 1-3/day on weekends buck: 1/yr ishwa: none this season	Religion (huhuri), social (bird,baboon), not available (cricket)	madora: buy from store, $2.30/200 g package ishwa: buy from mkt (Rusape) occasionally, 1 or 2 cups for $1/c.	Even if there was more wildlife, they can't use them due to their reasons. However, would like more wildlife because it has a right to exist. Ishwa does provide a change from meat although they still buy meat. WTP: $20. Would encourage a project. Meat=$20/mo ($5/wk).
ny-gu14	husband*, wife*, grandson	higher	1	birds, guinea fowl, mice, buck, (kudu) locust, humbi, ishwa, cricket, various caterpillars (madora, motho)	birds: due to circumstance, man gets 3-5 birds, children who collect young birds from nests guinea fowl: none in last couple yrs. mice: May-Jun, every day, 5-8/day (perhaps 10/day in May); Jun-Sept, every day, 2-4/day buck: Sept-Oct, 1/period locust: Apr-Jun, 0.5L/day don't collect every day humbi: Jan, 2-3 times/mo, up to 20/day madora: Apr-May, 1 trip/season, 4L/trip motho: Mid rains (Mar), 1 trip/season, 6L/trip ishwa: Sept-Nov, when available, children-1 cup, adults trap 15L/day.	Religion (wild pig)	kudu:Mar-June, buy from others who hunt, piece >1kg for $10 (cheaper than beef which is $15/kg)	No large game around now but used to be able to buy it in butchery. Consider small wildlife important part of diet but only available for a short period. Long ago there used to be lots but increase in residents so wildlife left & also people chased it away. Better if the wildlife is far away because it destroys crops. Used to hunt more therefore if wildlife was around it would be killed & if every hshld hunting then eventually would eliminate wildlife. As long as its not destructive then like small wildlife but mice are destructive.

ny-gu15	worker & his wife* (owner of holding lives in Harare)	lower	1	mice, locust	mice: trap every 2 days, 1-2 mice each time	Religion (madora, harati, motho, makurwe, humbi, hare), no one to collect (birds, buck)		Not concerned with having wildlife around because hard to collect. Even if she caught more mice she would still buy meat. Meat=$3.50-4.00, 4 times/mo.
ny-gu16	husband, wife*, 3 daughters, wife of a son (in town) & grand-daughter, 1 son	higher	1	mice, ishwa, madora, humbi	mice: harvest (Jun, 2 wks), every day, 2-3/day; July, trap 1/day humbi: Early rains (Oct) collected by children as hobby	Religion (motho), no one to collect (birds, buck, hare)	ishwa: buy from others, once or twice/season, 2c/time, $1.50/c madora: buy 4 packages/mo	Interested in wildlife as long as don't destroy crops. If more wildlife & insects around then may buy less meat WTP: provide poles & materials for project. Meat= $60/mo (4 times/mo, $15/kg)
ny-nk17	husband*, wife, son	middle	3	guinea fowl, mice, locust	guinea fowl: Nov-Dec, may come across eggs mice: harvest (May-Jun), every day, 2-6/day locust: harvest, every day, 10 or less/day	Has domestic rabbits so doesn't hunt hares even though abundant. Not interested in birds because difficult to collect. Need dogs or gun for buck.	Mkt too far away to buy or sell	Doesn't consider wildlife too important. Long ago there used to be lots of large game. Used to make 1 trip/mo with dogs for 1/2 day and might get 1 buck but now no longer go on trip. Now less game because land cleared for resettlement. If there was small game he would hunt and save his chickens & goats but difficult to hunt. Would like wildlife but not interested in project because may end up limiting nr of cattle. Meat-buys occasionally or uses livestock.

ny-nk18	husband*, wife*, daughter, 3 sons	middle	3	bird, locust, ishwa. madora, cricket	collect if they come across them	Religion (mice, hare, rock rabbit, wild pig)		Don't even like to destroy the wildlife they are allowed to consume. Small wildlife in environment is sacred even if not consumed.

TABLE D.4 Timeline



**** Represents the range of the season or agricultural activity.

XXX Wildlife seasons noted in Chinamura Field Study.

xxxx Wildlife seasons noted in Nyanga Field Study.

Note: The seasons and time of agricultural activities or wildlife collection may vary across the country.

APPENDIX E

LITERATURE SEARCH

A discussion of the literature search may seem unusual. However, because the purpose of this study is to be a guide for further research it is relevent to discuss what paths were explored. In particular this may be more useful to researchers from outside Zimbabwe.

An initial and subsequent literature search was conducted to gather any available, relevant secondary data and background information. The main areas of interest included theoretical evidence on valuation methodologies which would be examined in a Zimbabwean context. Available Zimbabwean valuation studies were examined. Also, of interest were applications of valuation methods in other countries, particularly in developing countries. Furthermore, household studies done in Zimbabwe, even in different fields, were used to determine potential research problems. Existing studies on small wildlife use were also collected and pieces of information relating to small wildlife were extracted from other studies. Available background information on households in communal areas were also used to build this description. This secondary data was used to supplement the field study data.

The literature search explored several sources including libraries, museums, institutions, organizations and personal literature collections. A list of these sources is included. This is of relevance to researchers wishing to further research in this area to be able to determine which sources were useful and what information is available.

Libraries that were consulted at the University of Zimbabwe, Harare, included the Main library and the departmental libraries of Agricultural Economics, Centre for Applied Social Sciences, Geography, and Rural and Urban Planning. The Main Library did not provide any information. However, the Agricultural Economics library had several relevant texts on valuation methods as well as Zimbabwean household

studies. CASS was also a very good source of information with relevant Zimbabwean studies and useful texts. A list of publications was obtained. Maps were obtained from the Geography, and Rural and Urban Planning libraries. The Surveyor General was another source of maps. The Publicity Department at the University of Zimbabwe also was a source of some relevant work done by the University of Zimbabwe. However, the Department of National Parks and Wildlife Management (DNPWM) library, Forestry Commission and Department of Veterinary Research library did not provide any relevant information. The mammalogy and entomology departments at the Natural History Museum, Bulawayo, were also visited. Researchers in these departments are possible contacts for scientific information and identification. Wildlife identification books for pictures of wildlife species would also be a useful supplement, particularly for work in the field. Several international organizations are also located in Harare and are a rich source of information. Lists of publications and bibliographies were obtained from World Wide Fund for Nature (WWF) and Zimtrust. However, because not much research has been done on small wildlife, these organizations could not supply any relevant studies. The International Union for the Conservation of Nature (IUCN) did not have publication lists however they are linked with CASS. Personal communication with different professors, students and acquaintances also supplemented the literature research and study.

The results of the literature search confirmed that very little research has been done in the area of this study, focusing on small wildlife. In fact, the collection of data on small wildlife was usually not a main objective of the studies they were included in but was collected as part of a broader data collection. Therefore the small wildlife data was not analysed in great detail in these studies. However, two key studies by Wilson (1990) and Chimedza (unpubl.) did

document wildlife use by households. This study should further contribute to the limited data that is currently available.